100 XP

Introduction

2 minutes

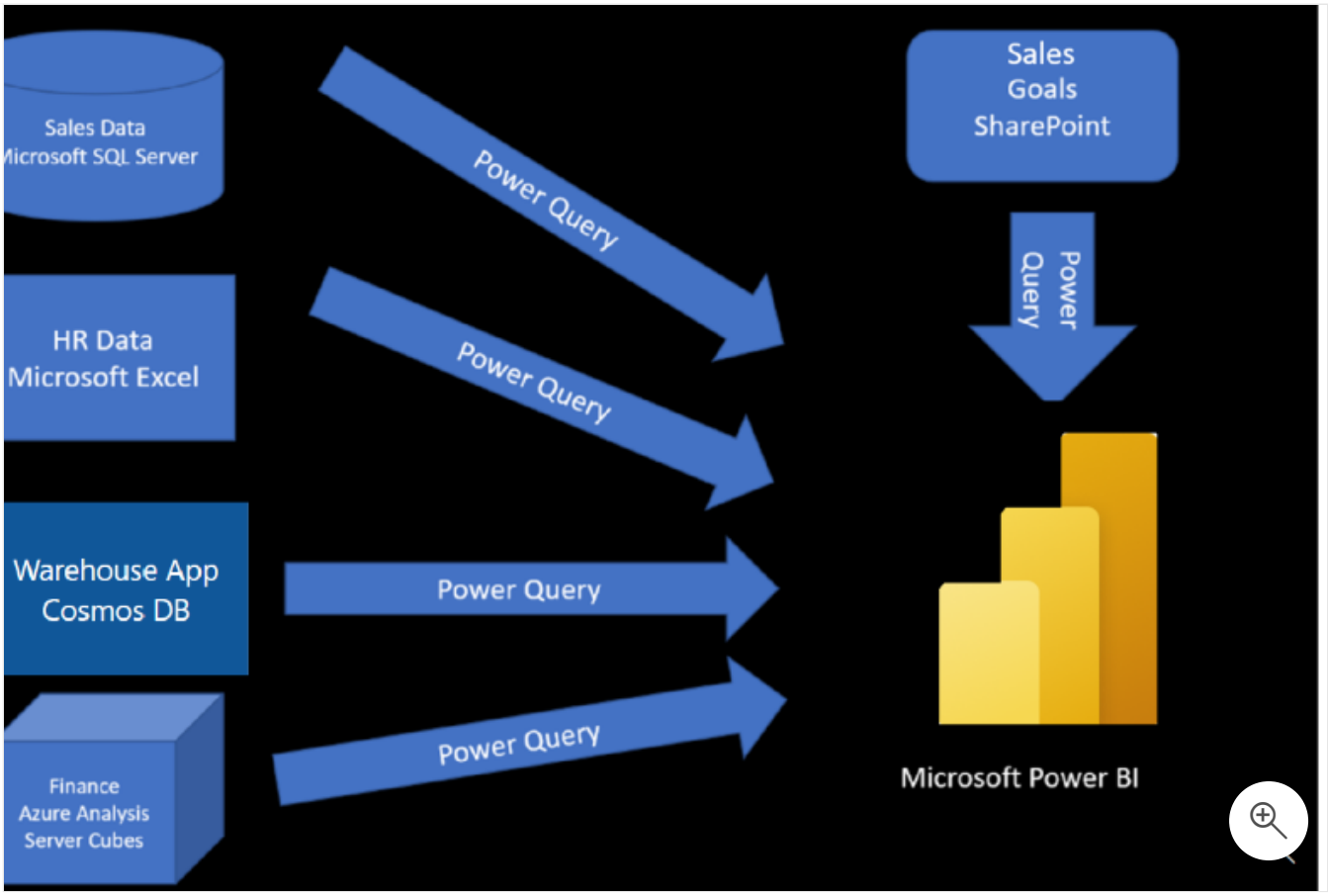
Like most of us, you work for a company where you're required to build Microsoft Power BI reports. The data resides in several different databases and files. These data repositories are different from each other, some are in Microsoft SQL Server, some are in Microsoft Excel, but all the data is related.
https://www.microsoft.com/en-us/videoplayer/embed/RWFSPW?postJsllMsg=true

> **Note**
>
> The module sections prior to the lab are purely informational. You will be given the opportunity to work with real data during the lab.

In this module's scenario, you work for Tailwind Traders. You've been tasked by senior leadership to create a suite of reports that are dependent on data in several different locations. The database that tracks sales transactions is in SQL Server, a relational database that contains what items each customer bought and when. It also tracks which employee made the sale, along with the employee name and employee ID. However, that database doesn't contain the employee's hire date, their title, or who their manager is. For that information, you need to access files that Human Resources keeps in Excel. You've been consistently requesting that they use an SQL database, but they haven't yet had the chance to implement it.

When an item ships, the shipment is recorded in the warehousing application, which is new to the company. The developers chose to store data in Cosmos DB, as a set of JSON documents.

Tailwind Traders has an application that helps with financial projections, so that they can predict what their sales will be in future months and years, based on past trends. Those projections are stored in Microsoft Azure Analysis Services. Here's a view of the many data sources you're asked to combine data from.



Before you can create reports, you must first extract data from the various data sources. Interacting with SQL Server is different from Excel, so you should learn the nuances of both systems. After gaining understanding of the systems, you can use Power Query to help you clean the data, such as renaming columns, replacing values, removing errors, and combining query results. Power Query is also available in Excel. After the data has been cleaned and organized, you're ready to build reports in Power BI. Finally, you'll publish your combined dataset and reports to Power BI service. From there, other people can use your dataset and build their own reports or they can use the reports you've already built. Additionally, if someone else built a dataset you'd like to use, you can build reports from that too!

This module will focus on the first step of getting the data from the different data sources and importing it into Power BI by using Power Query.

By the end of this module, you'll be able to:

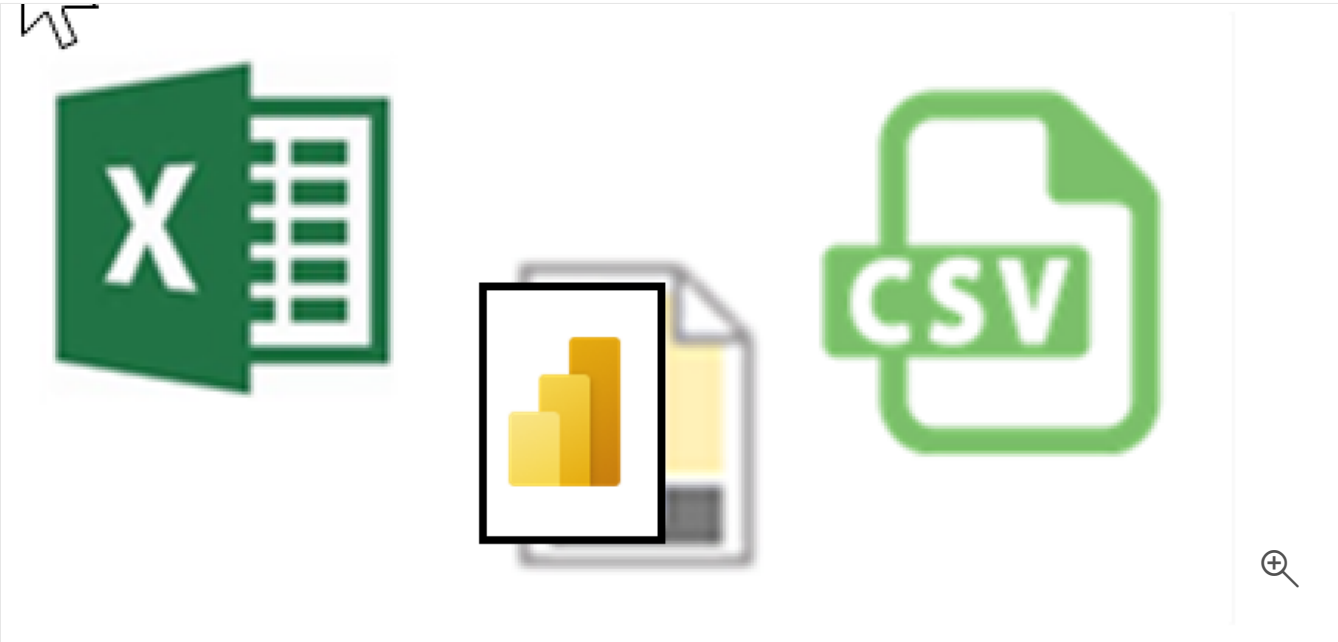
- Identify and connect to a data source
- Get data from a relational database, such as Microsoft SQL Server
- Get data from a file, such as Microsoft Excel
- Get data from applications
- Get data from Azure Analysis Services
- Select a storage mode
- Fix performance issues
- Resolve data import errors

100 XP

Get data from files

10 minutes

Organizations often export and store data in files. One possible file format is a flat file. A flat file is a type of file that has only one data table and every row of data is in the same structure. The file doesn't contain hierarchies. Likely, you're familiar with the most common types of flat files, which are comma-separated values (.csv) files, delimited text (.txt) files, and fixed width files. Another type of file would be the output files from different applications, like Microsoft Excel workbooks (.xlsx).



Power BI Desktop allows you to get data from many types of files. You can find a list of the available options when you use the **Get data** feature in Power BI Desktop. The following sections explain how you can import data from an Excel file that is stored on a local computer.

Scenario

The Human Resources (HR) team at Tailwind Traders has prepared a flat file that contains some of your organization's employee data, such as employee name, hire date, position, and manager. They've requested that you build Power BI reports by using this data, and data that is located in several other data sources.

Flat file location

The first step is to determine which file location you want to use to export and store your data.

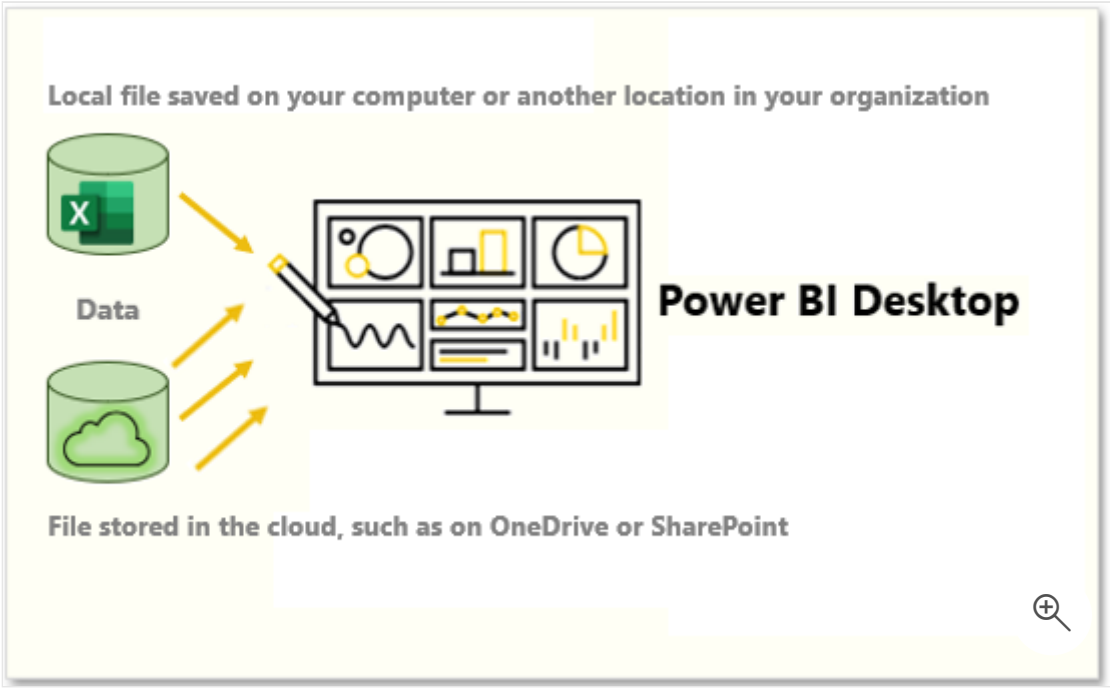
Your Excel files might exist in one of the following locations:

- **Local** - You can import data from a local file into Power BI. The file isn't moved into Power BI, and a link doesn't remain to it. Instead, a new dataset is created in Power BI, and data from the Excel file is loaded into it. Accordingly, changes to the original Excel file aren't reflected in your Power BI dataset. You can use local data import for data that doesn't change.

- **OneDrive for Business** - You can pull data from OneDrive for Business into Power BI. This method is effective in keeping an Excel file and your dataset, reports, and dashboards in Power BI synchronized. Power BI connects regularly to your file on OneDrive. If any changes are found, your dataset, reports, and dashboards are automatically updated in Power BI.

- **OneDrive - Personal** - You can use data from files on a personal OneDrive account, and get many of the same benefits that you would with OneDrive for Business. However, you'll need to sign in with your personal OneDrive account, and select the **Keep me signed in** option. Check with your system administrator to determine whether this type of connection is allowed in your organization.

- **SharePoint - Team Sites** - Saving your Power BI Desktop files to SharePoint Team Sites is similar to saving to OneDrive for Business. The main difference is how you connect to the file from Power BI. You can specify a URL or connect to the root folder.

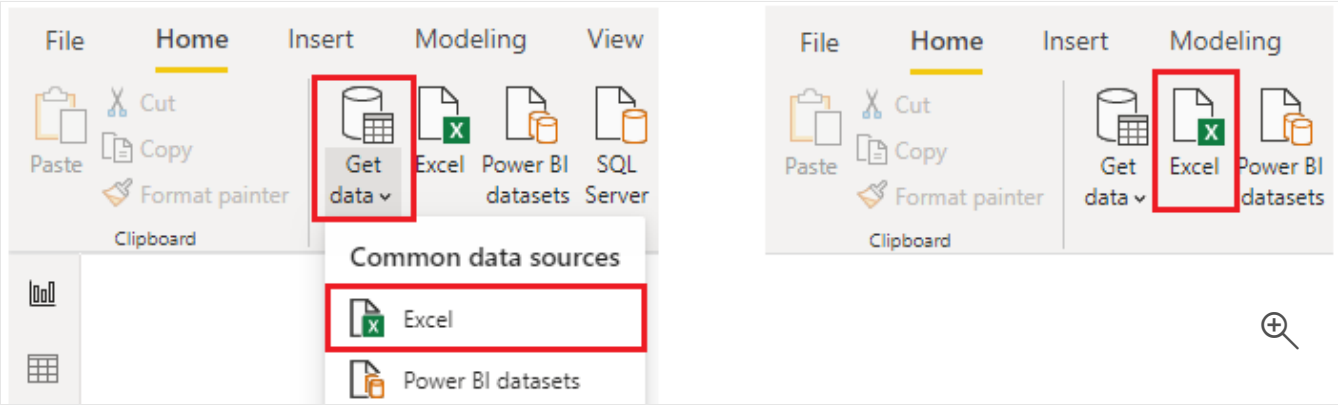


Using a cloud option such as OneDrive or SharePoint Team Sites is the most effective way to keep your file and your dataset, reports, and dashboards in Power BI in-sync. However, if your data doesn't change regularly, saving files on a local computer is a suitable option.

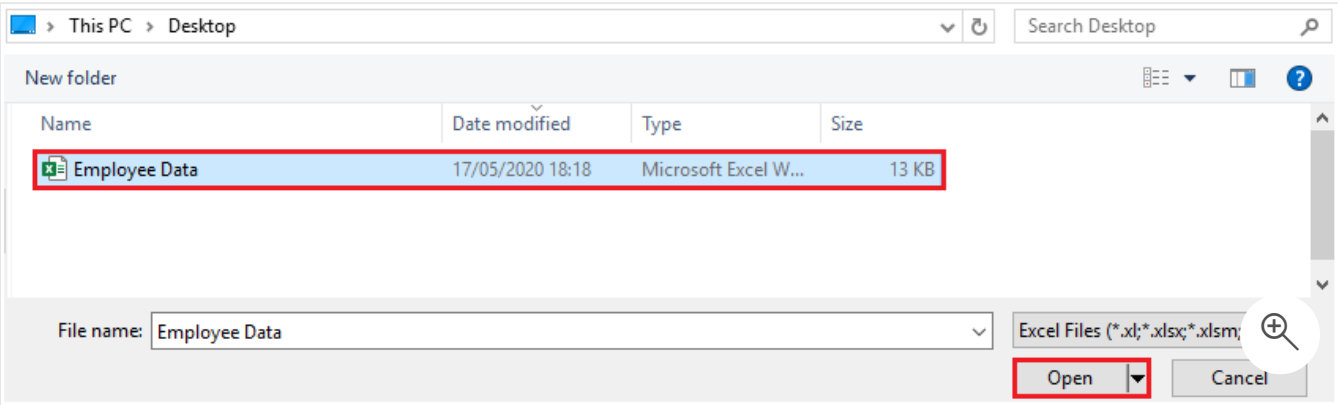
Connect to data in a file

In Power BI, on the **Home** tab, select **Get data**. In the list that displays, select the option that you require, such as **Text/CSV** or **XML**. For this example, you'll select **Excel**.

> **Tip**
>
> The **Home** tab contains quick access data source options, such as **Excel**, next to the **Get data** button.



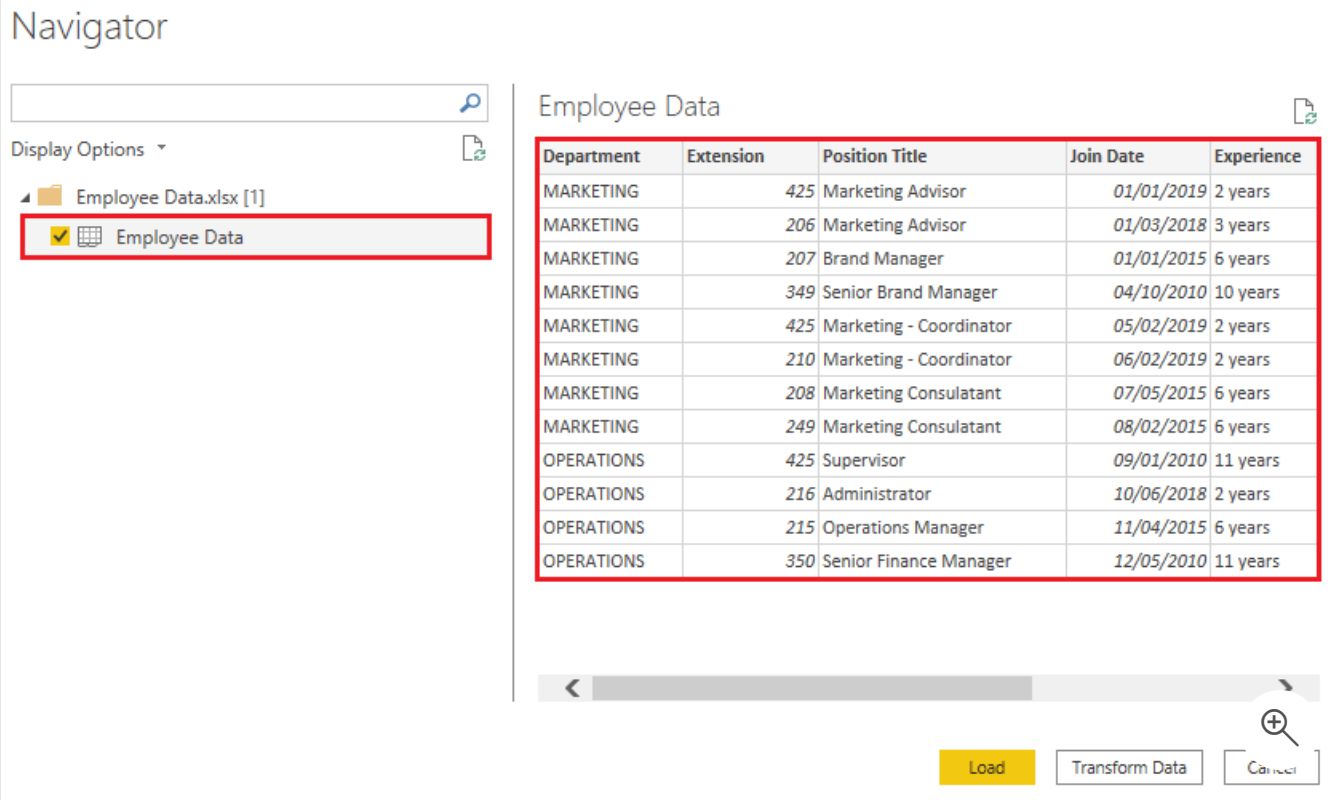
Depending on your selection, you need to find and open your data source. You might be prompted to sign into a service, such as OneDrive, to authenticate your request. In this example, you'll open the **Employee Data** Excel workbook that is stored on the Desktop (Remember, no files are provided for practice, these are hypothetical steps).



Select the file data to import

After the file has connected to Power BI Desktop, the **Navigator** window opens. This window shows you the data that is available in your data source (the Excel file in this example). You can select a table or entity to preview its contents, to ensure that the correct data is loaded into the Power BI model.

Select the check box(es) of the table(s) that you want to bring in to Power BI. This selection activates the **Load** and **Transform Data** buttons as shown in the following image.



Department	Extension	Position Title	Join Date	Experience
MARKETING	425	Marketing Advisor	01/01/2019	2 years
MARKETING	206	Marketing Advisor	01/03/2018	3 years
MARKETING	207	Brand Manager	01/01/2015	6 years
MARKETING	349	Senior Brand Manager	04/10/2010	10 years
MARKETING	425	Marketing - Coordinator	05/02/2019	2 years
MARKETING	210	Marketing - Coordinator	06/02/2019	2 years
MARKETING	208	Marketing Consulatant	07/05/2015	6 years
MARKETING	249	Marketing Consulatant	08/02/2015	6 years
OPERATIONS	425	Supervisor	09/01/2010	11 years
OPERATIONS	216	Administrator	10/06/2018	2 years
OPERATIONS	215	Operations Manager	11/04/2015	6 years
OPERATIONS	350	Senior Finance Manager	12/05/2010	11 years

Now you can select the **Load** button to automatically load your data into the Power BI model or select the **Transform Data** button to launch the Power Query Editor, where you can review and clean your data before loading it into the Power BI model.

We often recommend that you transform data, but that process will be discussed later in this module. For this example, you can select **Load**.

Change the source file

You might have to change the location of a source file for a data source during development, or if a file storage location changes. To keep your reports up to date, you'll need to update your file connection paths in Power BI.

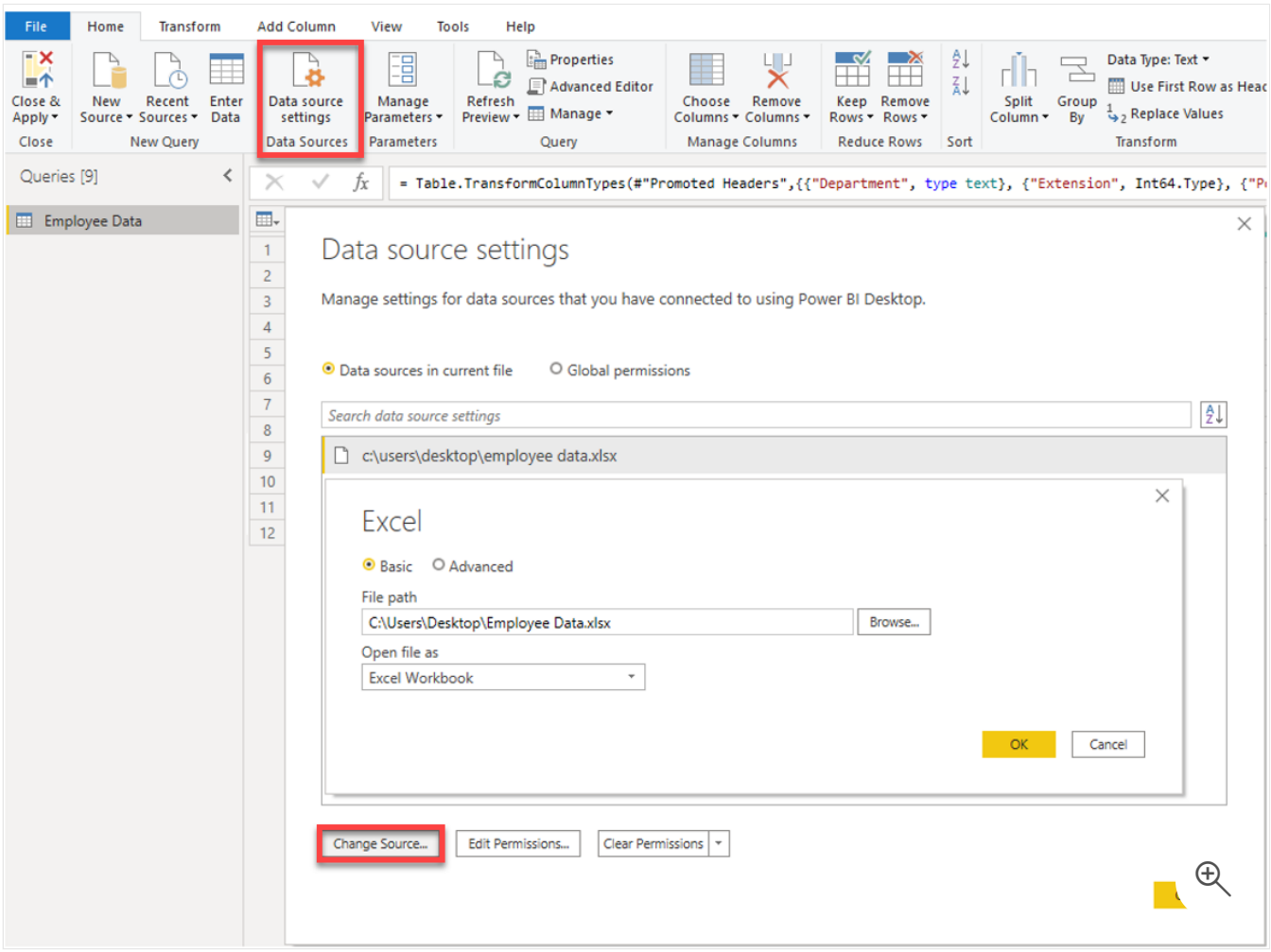
Power Query provides many ways for you to accomplish this task, so that you can make this type of change when needed.

1. Data source settings
2. Query settings
3. Advanced Editor

> ⚠ **Warning**

If you are changing a file path, make sure that you reconnect to the same file with the same file structure. Any structural changes to a file, such as deleting or renaming columns in the source file, will break the reporting model.

For example, try changing the data source file path in the data source settings. Select **Data source settings** in Power Query. In the **Data source settings** window, select your file and then select **Change Source**. Update the **File path** or use the **Browse** option to locate your file, select **OK**, and then select **Close**.



Next unit: Get data from relational data sources

Continue >

How are we doing? ☆ ☆ ☆ ☆ ☆

100 XP

Get data from relational data sources

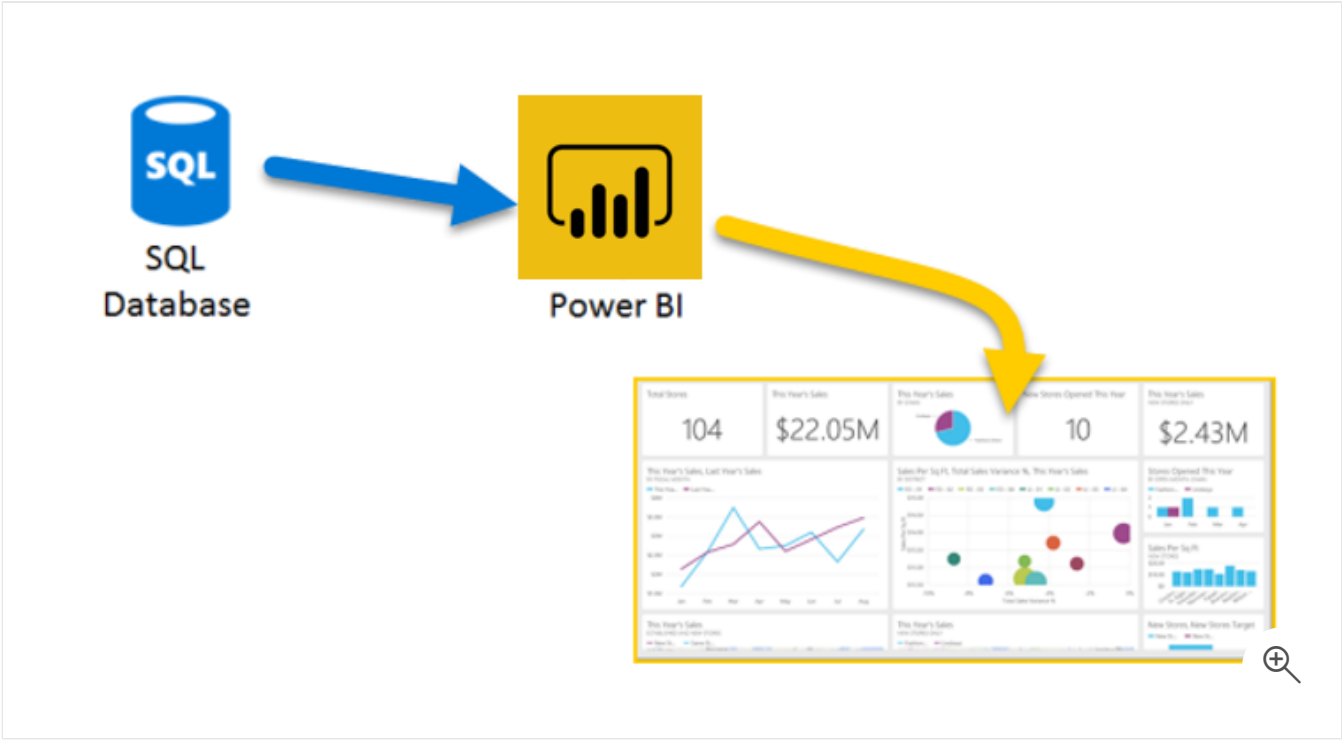
14 minutes

If your organization uses a relational database for sales, you can use Power BI Desktop to connect directly to the database instead of using exported flat files.

Connecting Power BI to your database will help you to monitor the progress of your business and identify trends, so you can forecast sales figures, plan budgets and set performance indicators and targets. Power BI Desktop can connect to many relational databases that are either in the cloud or on-premises.

Scenario

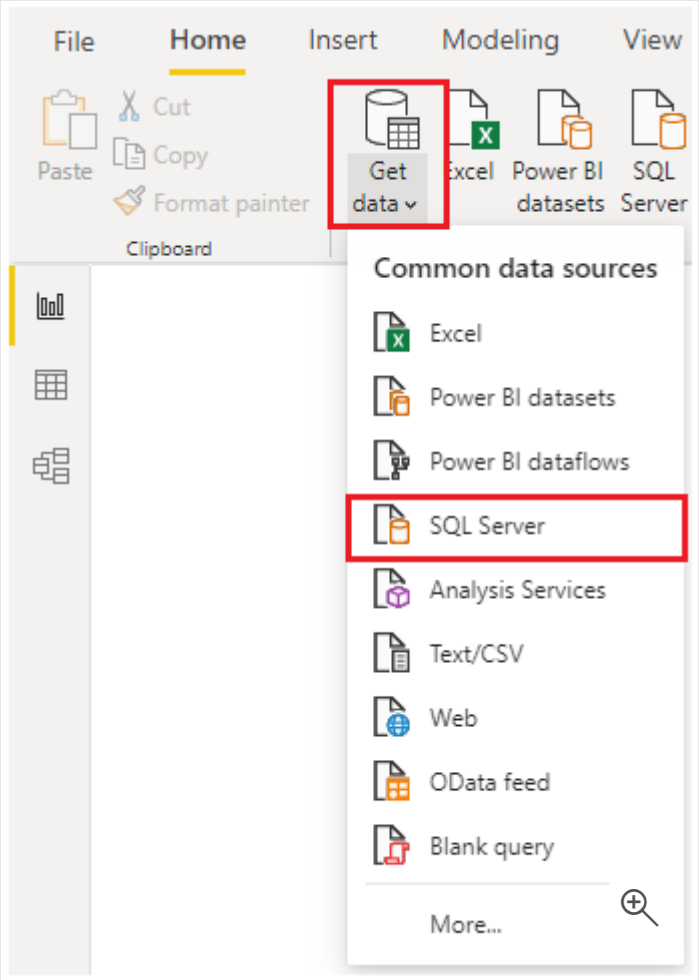
The Sales team at Tailwind Traders has requested that you connect to the organization's on-premises SQL Server database and get the sales data into Power BI Desktop so you can build sales reports.



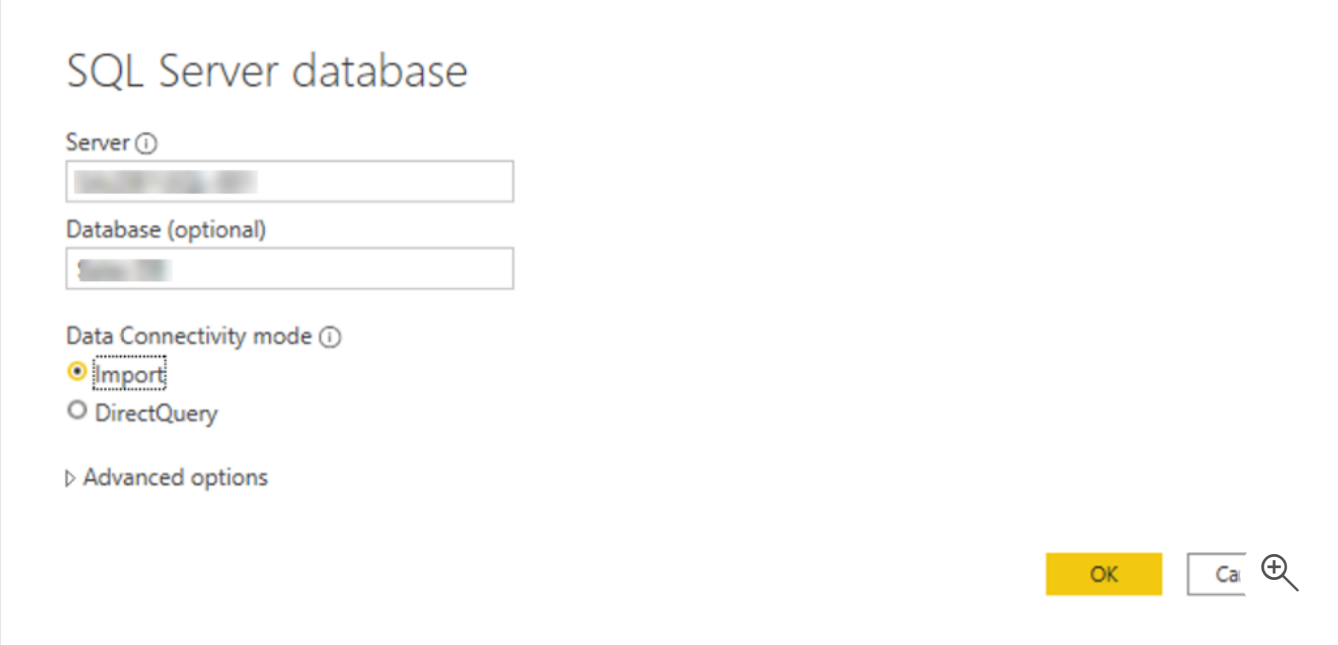
Connect to data in a relational database

You can use the **Get data** feature in Power BI Desktop and select the applicable option for your relational database. For this example, you would select the **SQL Server** option, as shown in the following screenshot.

> **Tip**
>
> Next to the **Get Data** button are quick access data source options, such as **SQL Server.**



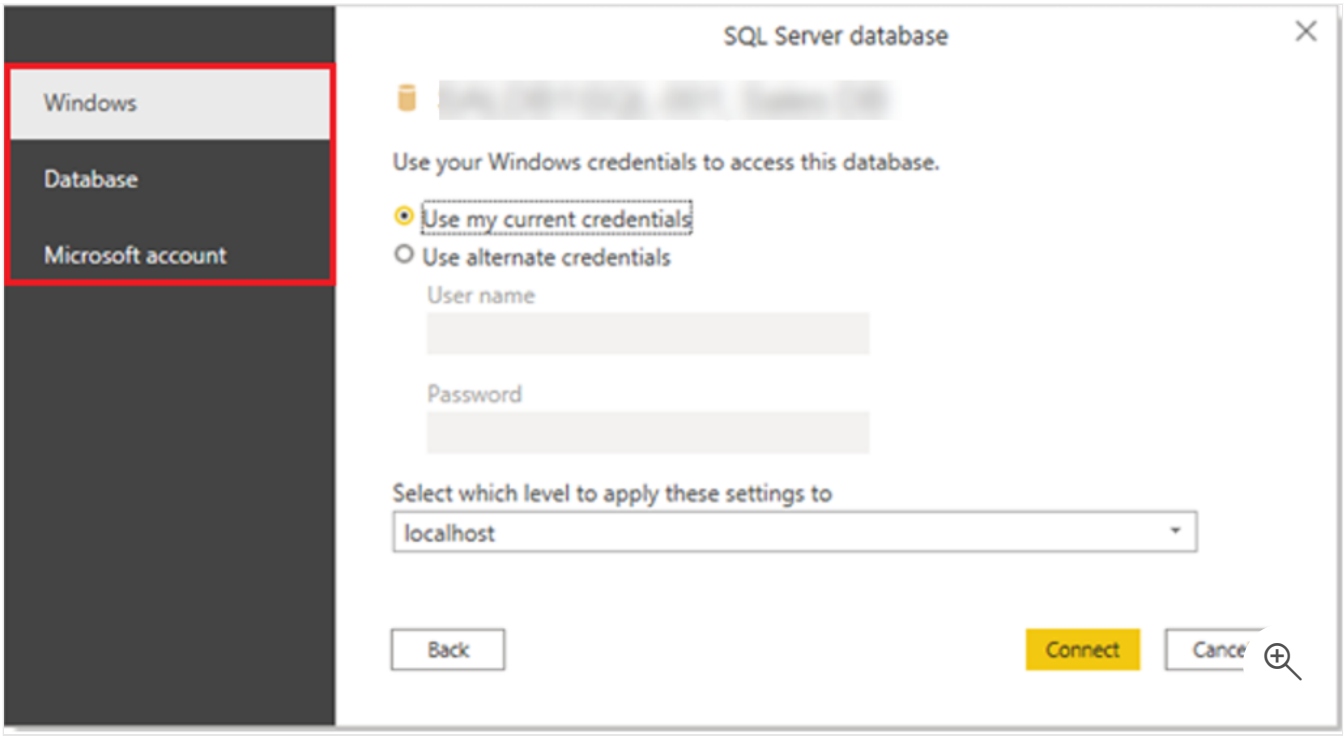
Your next step is to enter your database server name and a database name in the **SQL Server database** window. The two options in data connectivity mode are: **Import** (selected by default, recommended) and **DirectQuery**. Mostly, you select **Import.** Other advanced options are also available in the **SQL Server database** window, but you can ignore them for now.



After you've added your server and database names, you'll be prompted to sign in with a username and password. You'll have three sign-in options:

- **Windows** - Use your Windows account (Azure Active Directory credentials).
- **Database** - Use your database credentials. For instance, SQL Server has its own sign-in and authentication system that is sometimes used. If the database administrator gave you a unique sign-in to the database, you might need to enter those credentials on the **Database** tab.
- **Microsoft account** - Use your Microsoft account credentials. This option is often used for Azure services.

Select a sign-in option, enter your username and password, and then select **Connect**.

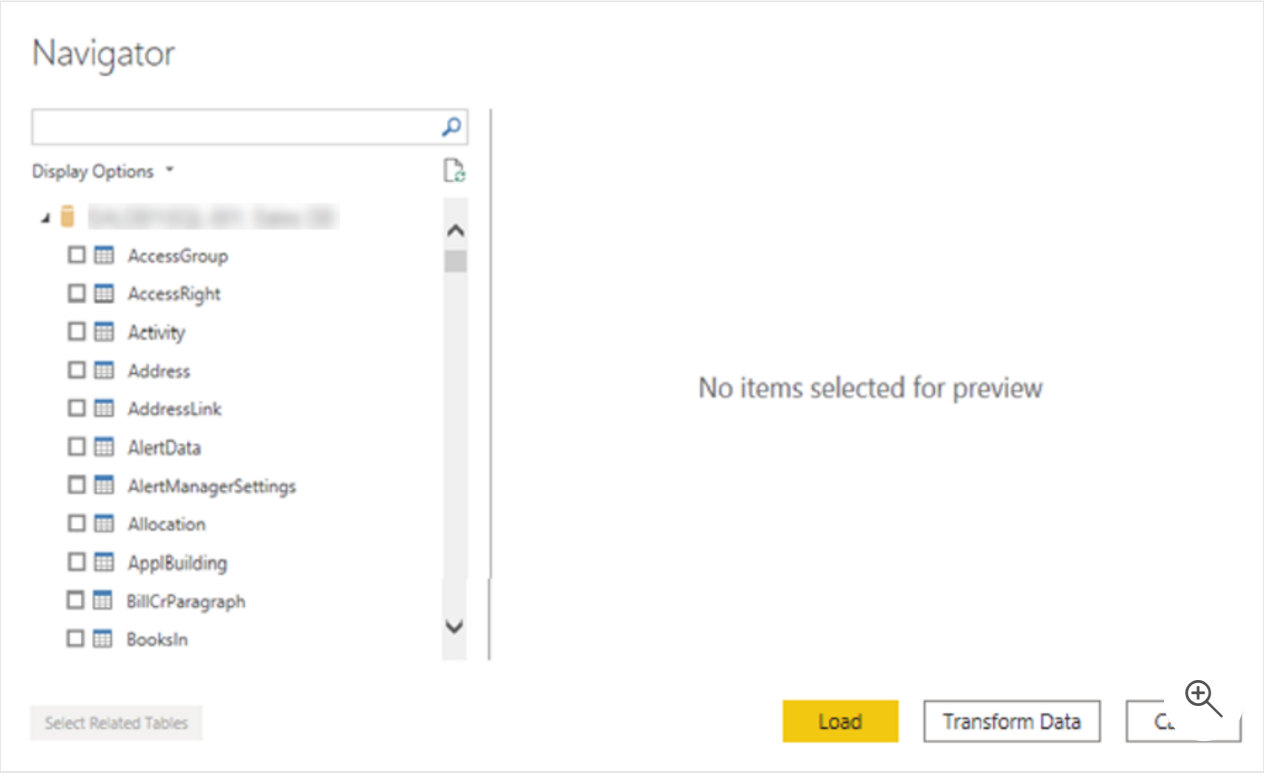


Select data to import

After the database has been connected to Power BI Desktop, the **Navigator** window displays the data that is available in your data source (the SQL database in this example). You can select a table or entity to preview its contents and make sure that the correct data will be loaded into the Power BI model.

Select the check box(es) of the table(s) that you want to bring in to Power BI Desktop, and then select either the **Load** or **Transform Data** option.

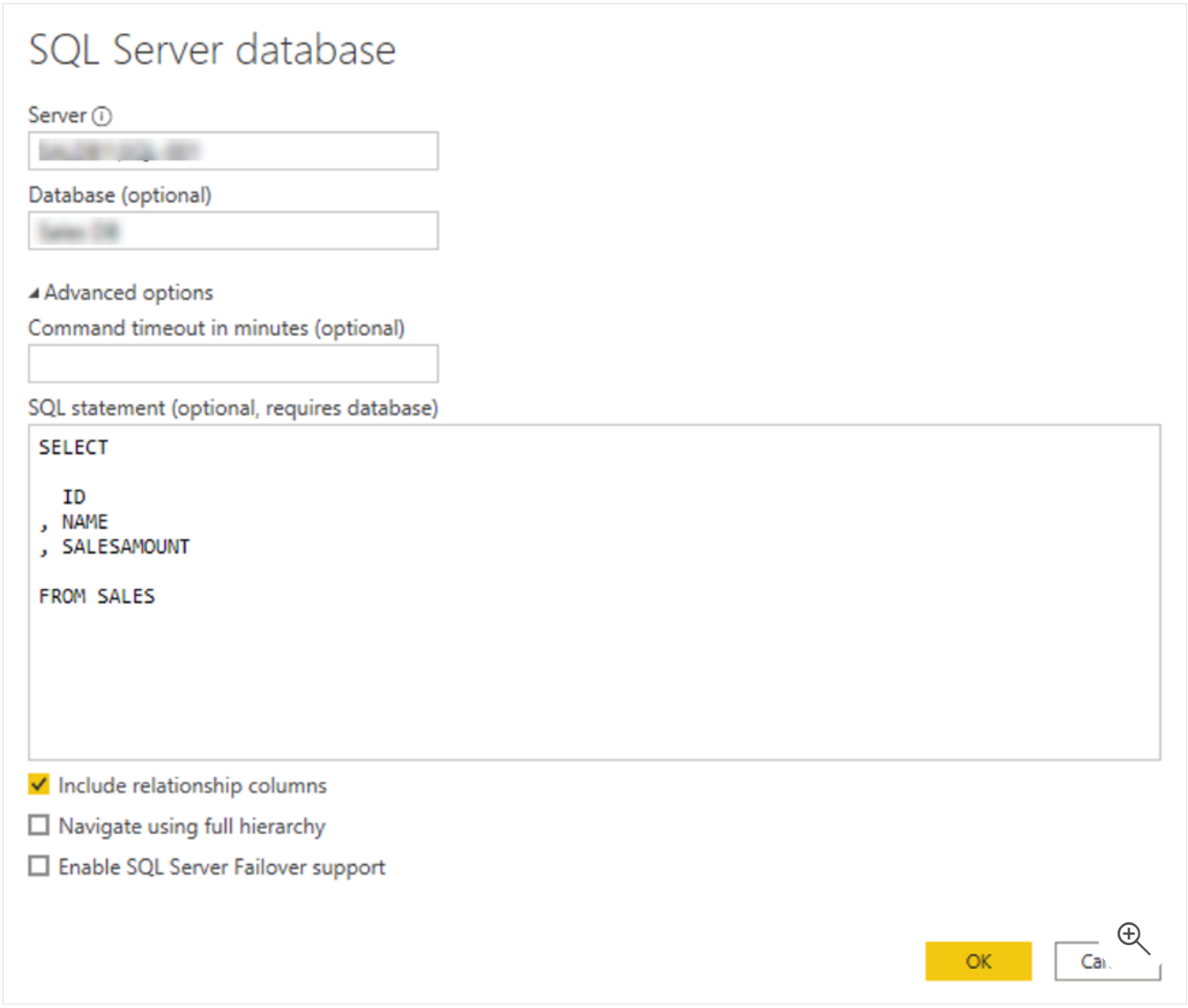
- **Load** - Automatically load your data into a Power BI model in its current state.
- **Transform Data** - Open your data in Microsoft Power Query, where you can perform actions such as deleting unnecessary rows or columns, grouping your data, removing errors, and many other data quality tasks.



Import data by writing an SQL query

Another way you can import data is to write an SQL query to specify only the tables and columns that you need.

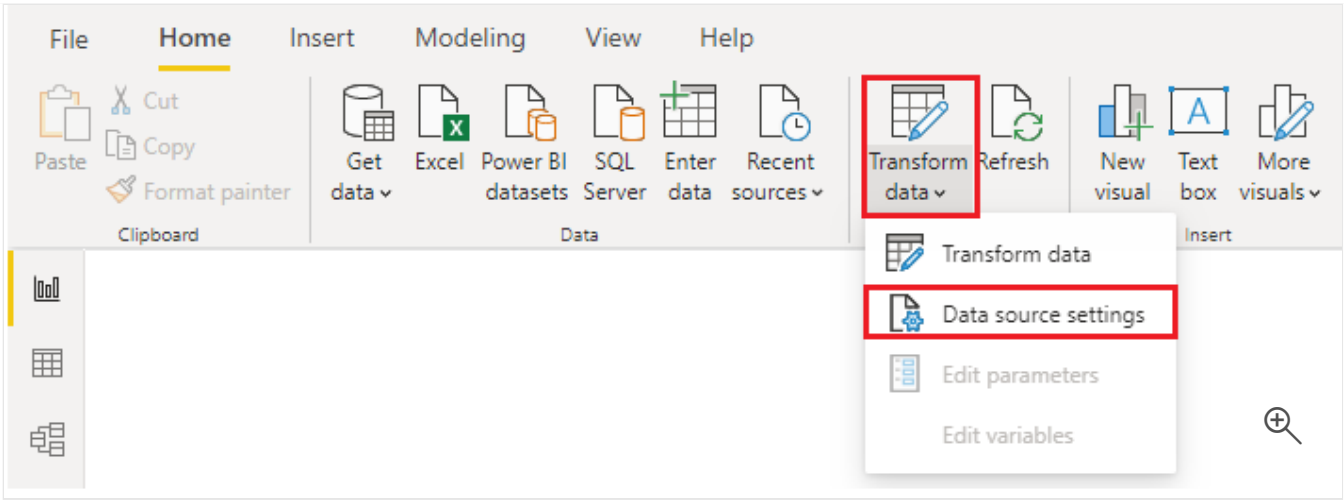
To write your SQL query, on the **SQL Server database** window, enter your server and database names, and then select the arrow next to **Advanced options** to expand this section and view your options. In the **SQL statement** box, write your query statement, and then select **OK**. In this example, you'll use the **Select** SQL statement to load the ID, NAME and SALESAMOUNT columns **from** the SALES table.



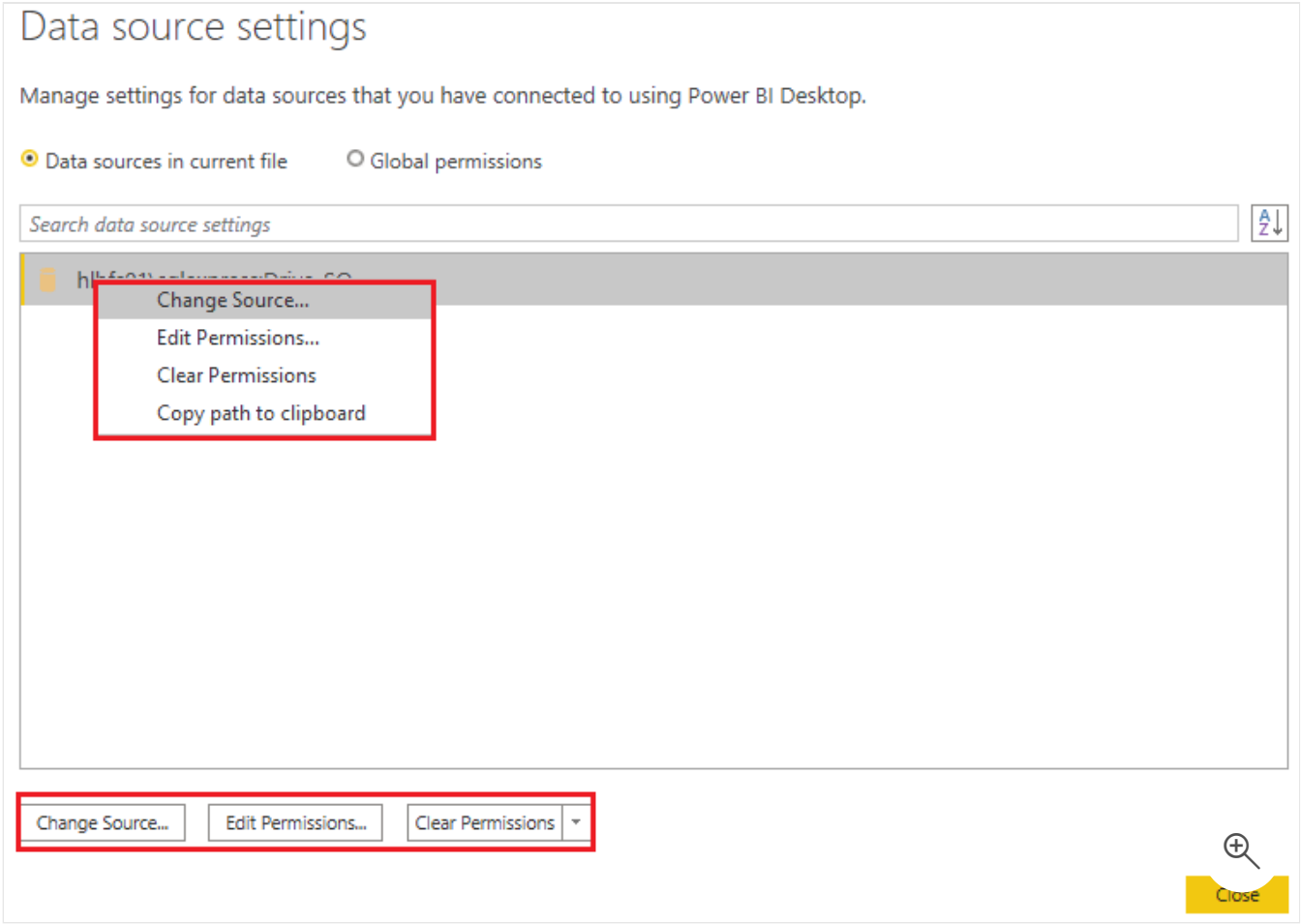
Change data source settings

After you create a data source connection and load data into Power BI Desktop, you can return and change your connection settings at any time. This action is often required due to a security policy within the organization, for example, when the password needs to be updated every 90 days. You can change the data source, edit permissions or clear permissions.

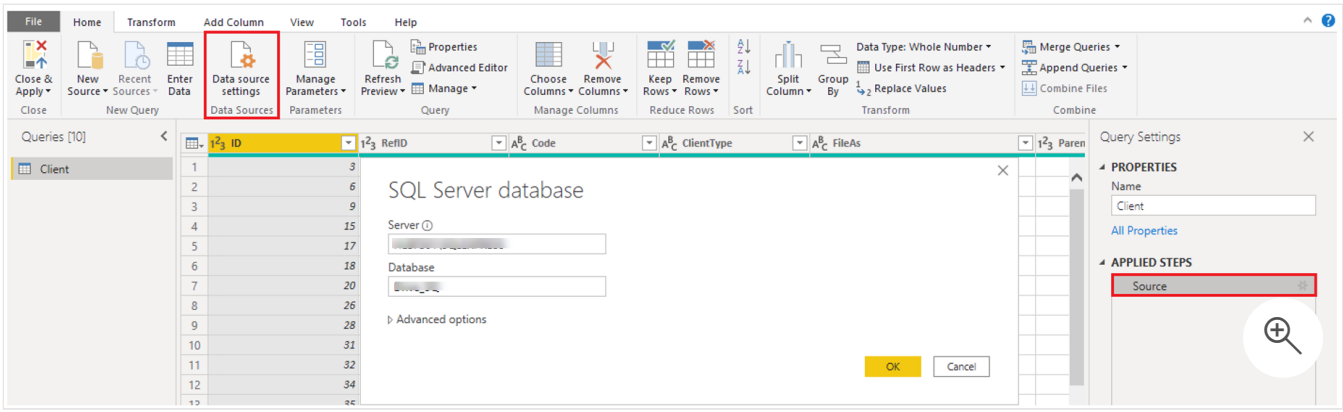
On the **Home** tab, select **Transform data,** and then select the **Data source settings** option.



From the list of data sources that displays, select the data source that you want to update. Then, you can right-click that data source to view the available update options or you can use the update option buttons on the lower left of the window. Select the update option that you need, change the settings as required, and then apply your changes.



You can also change your data source settings from within Power Query. Select the table, and then select the **Data source settings** option on the **Home** ribbon. Alternatively, you can go to the **Query Settings** panel on the right side of the screen and select the settings icon next to Source (or double Select Source). In the window that displays, update the server and database details, and then select **OK**.



After you have made the changes, select **Close and Apply** to apply those changes to your data source settings.

Write an SQL statement

As previously mentioned, you can import data into your Power BI model by using an SQL query. SQL stands for Structured Query Language and is a standardized programming language that is used to manage relational databases and perform various data management operations.

Consider the scenario where your database has a large table that is comprised of sales data over several years. Sales data from 2009 isn't relevant to the report that you're creating. This situation is where SQL is beneficial because it allows you to load only the required set of data by specifying exact columns and rows in your SQL statement and then importing them into your data model. You can also join different tables, run specific calculations, create logical statements, and filter data in your SQL query.

The following example shows a simple query where the ID, NAME and SALESAMOUNT are selected from the SALES table.

The SQL query starts with a **Select** statement, which allows you to choose the specific fields that you want to pull from your database. In this example, you want to load the ID, NAME, and SALESAMOUNT columns.

SQL

```
SELECT
ID
, NAME
, SALESAMOUNT
FROM
```

FROM specifies the name of the table that you want to pull the data from. In this case, it's the SALES table. The following example is the full SQL query:

```SQL
SELECT
ID
, NAME
, SALESAMOUNT
FROM
SALES
```

When using an SQL query to import data, try to avoid using the wildcard character (*) in your query. If you use the wildcard character (*) in your SELECT statement, you import all columns that you don't need from the specified table.

The following example shows the query using the wildcard character.

```SQL
SELECT *
FROM
SALES
```

The wildcard character (*) will import all columns within the **Sales** table. This method isn't recommended because it will lead to redundant data in your data model, which will cause performance issues and require extra steps to normalize your data for reporting.

All queries should also have a **WHERE** clause. This clause will filter the rows to pick only filtered records that you want. In this example, if you want to get recent sales data after January 1st, 2020, add a **WHERE** clause. The evolved query would look like the following example.

```SQL
SELECT
ID
, NAME
, SALESAMOUNT
FROM
SALES
WHERE
OrderDate >= '1/1/2020'
```

It's a best practice to avoid doing this directly in Power BI. Instead, consider writing a query like this in a view. A view is an object in a relational database, similar to a table. Views have rows and columns, and can contain almost every operator in the SQL language. If Power BI uses a view, when it retrieves data, it participates in query folding, a feature of Power Query. Query folding will be explained later, but in short, Power Query will optimize data retrieval according to how the data is being used later.

100 XP

Create dynamic reports with parameters

6 minutes

Dynamic reports are reports in which the data can be changed by a developer according to user specifications. Dynamic reports are valuable because a single report can be used for multiple purposes. If you use dynamic reports, you'll have fewer individual reports to create, which will save organizational time and resources.

You can use parameters by determining the values that you want to see data for in the report, and the report updates accordingly by filtering the data for you.

Creating dynamic reports allows you to give users more power over the data that is displayed in your reports; they can change the data source and filter the data by themselves.

In the following example, you've created a report for the Sales team at Tailwind Traders that displays the sales data in the SQL Server database. The report gives a holistic view of how the Sales team is performing. While the report is useful, the Sales team members want to be able to filter the report so that they can view their own data only and track their performance against their sales targets.

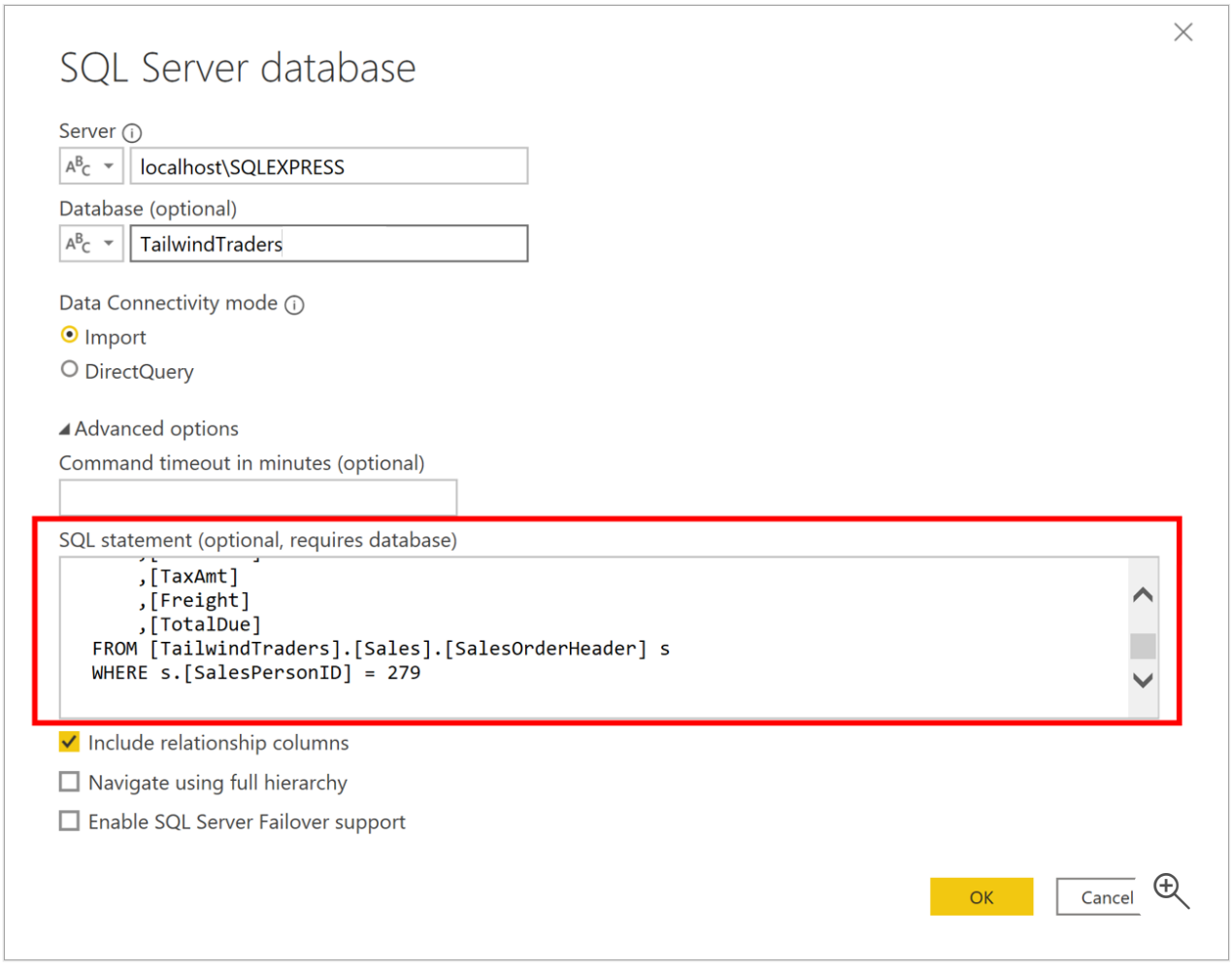
Create dynamic reports for individual values

To create a dynamic report, you first need to write your SQL query. Then use the **Get data** feature in Power BI Desktop to connect to the database.

In this example, you connect to your database on SQL Server by following these steps:

1. After you have entered your server details, in the **SQL Server database** window, select **Advanced options**.
2. Paste the SQL query into the **SQL statement** box and then select **OK**.

```
SELECT [SalesOrderID]
      ,[OrderDate]
      ,[OnlineOrderFlag]
      ,[SalesOrderNumber]
      ,[CustomerID]
      ,[SalesPersonID]
      ,[TerritoryID]
      ,[SubTotal]
      ,[TaxAmt]
      ,[Freight]
      ,[TotalDue]
  FROM [TailwindTraders].[Sales].[SalesOrderHeader] s
  WHERE s.[SalesPersonID] = 279
```



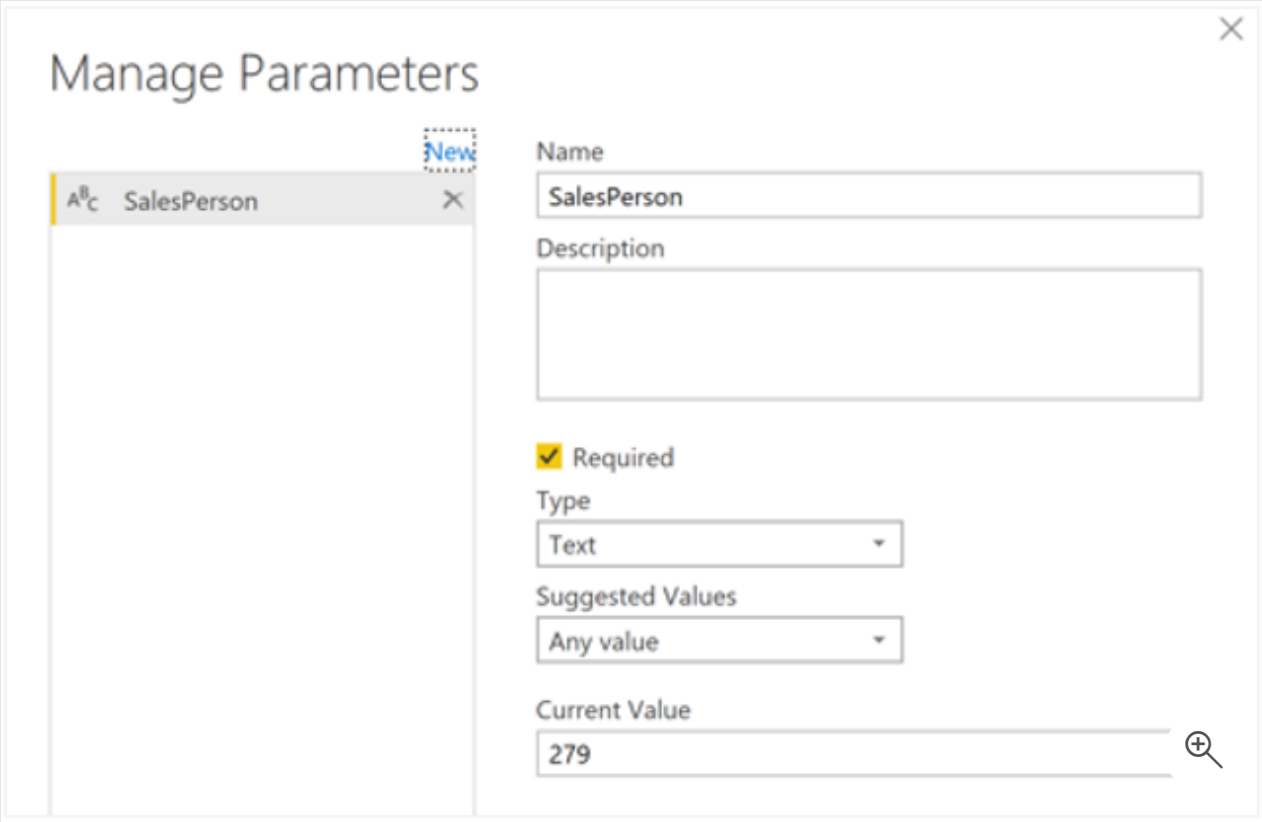
When the connection is made, the data is shown in the preview window.

3. Select **Edit** to open the data in Power Query Editor.

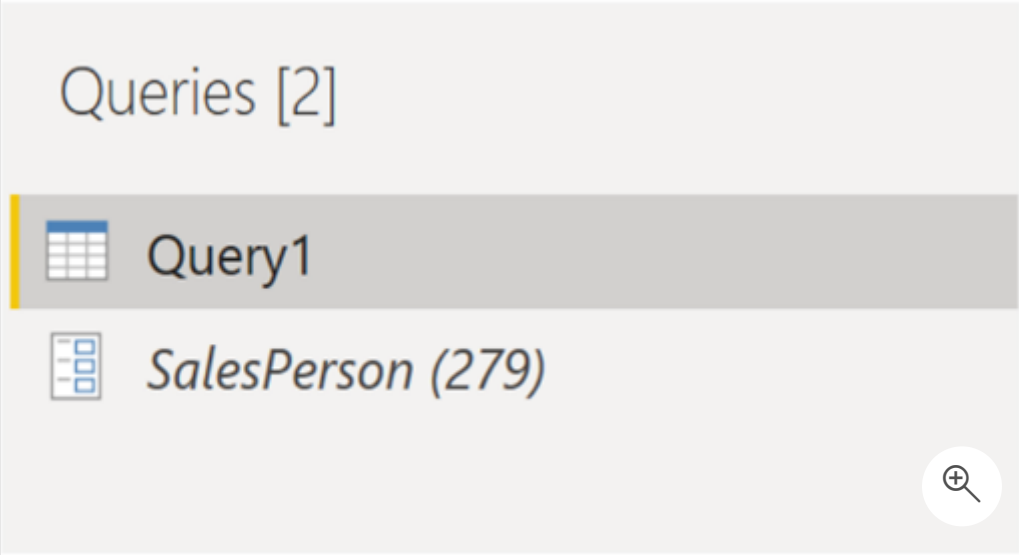
Next, you create the parameter by following these steps:

1. On the **Home** tab, select **Manage parameters** > **New parameter**.

2. On the **Parameters** window, change the default parameter name to something more descriptive so that its purpose is clear. In this case, you change the name to **SalesPerson**.
3. Select **Text** from the **Type** list and then select **Any value** from the **Suggested value** list.
4. Select **OK**.



A new query is shown for the parameter that you created.



Now, you need to adjust the code in SQL query to assess your new parameter:

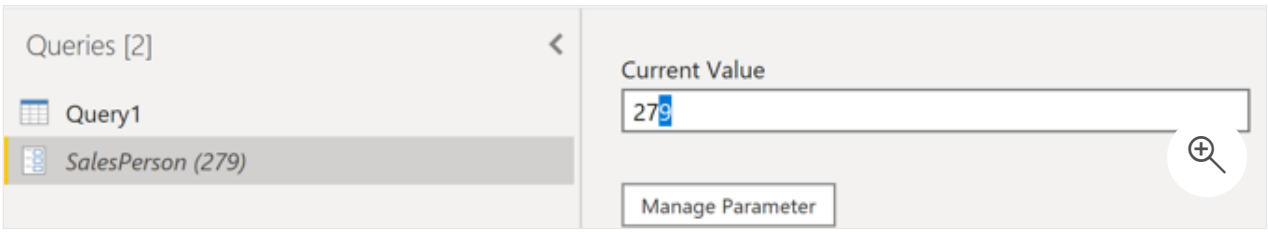
1. Right-click **Query1** and then select **Advanced editor**.

2. Replace the existing value in the execute statement with an ampersand (**&**) followed by your parameter name (**SalesPerson**), as illustrated in the following image.

3. Make sure that no errors are shown at bottom of the window and then select **Done**.

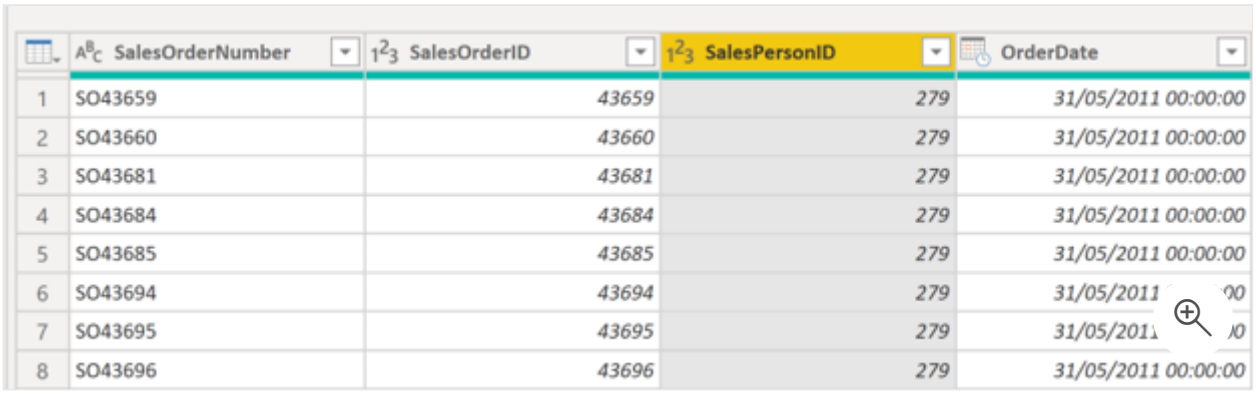
Though you don't see a difference on the screen, Power BI ran the query.

4. To confirm that the query was run, you can run a test by selecting the parameter query and entering a new value in the **Current Value** box.



5. A warning icon might display next to the query. If so, select that query to view the warning message, which states that permission is required to run this native database query. Select **Edit Permission** and then select **Run**.

   When the query runs successfully, the parameter displays the new value.



	SalesOrderNumber	SalesOrderID	SalesPersonID	OrderDate
1	SO43659	43659	279	31/05/2011 00:00:00
2	SO43660	43660	279	31/05/2011 00:00:00
3	SO43681	43681	279	31/05/2011 00:00:00
4	SO43684	43684	279	31/05/2011 00:00:00
5	SO43685	43685	279	31/05/2011 00:00:00
6	SO43694	43694	279	31/05/2011
7	SO43695	43695	279	31/05/201
8	SO43696	43696	279	31/05/2011 00:00:00

6. Select **Close and Apply** to return to the report editor.

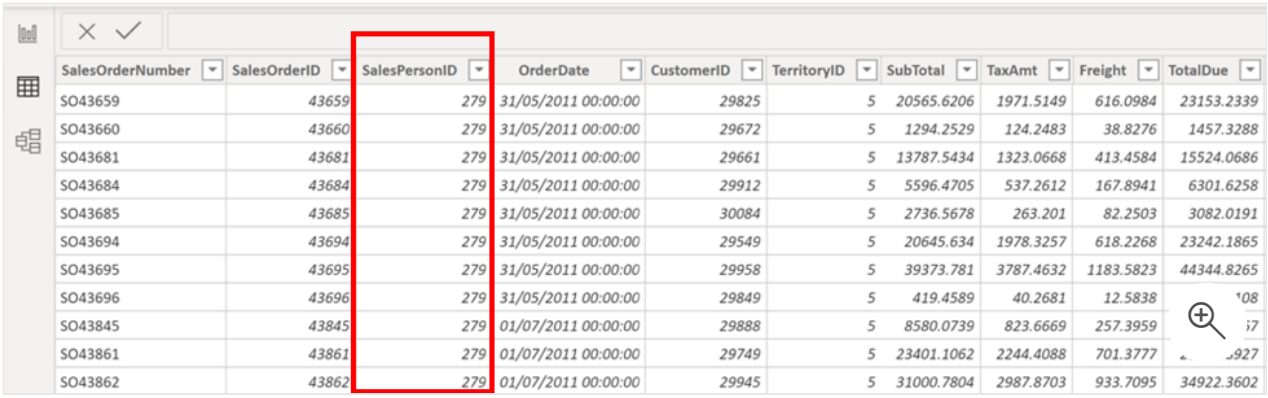
Now, you can apply the parameter to the report:

1. Select **Edit queries** > **Edit parameters**.

2. On the **Edit Parameters** window, enter a new value and then select **OK**.

3. Select **Apply changes** and then run the native query again.

Now, when you view the data, you see the data for the new value that was passed through the parameter.



SalesOrderNumber	SalesOrderID	SalesPersonID	OrderDate	CustomerID	TerritoryID	SubTotal	TaxAmt	Freight	TotalDue
SO43659	43659	279	31/05/2011 00:00:00	29825	5	20565.6206	1971.5149	616.0984	23153.2339
SO43660	43660	279	31/05/2011 00:00:00	29672	5	1294.2529	124.2483	38.8276	1457.3288
SO43681	43681	279	31/05/2011 00:00:00	29661	5	13787.5434	1323.0668	413.4584	15524.0686
SO43684	43684	279	31/05/2011 00:00:00	29912	5	5596.4705	537.2612	167.8941	6301.6258
SO43685	43685	279	31/05/2011 00:00:00	30084	5	2736.5678	263.201	82.2503	3082.0191
SO43694	43694	279	31/05/2011 00:00:00	29549	5	20645.634	1978.3257	618.2268	23242.1865
SO43695	43695	279	31/05/2011 00:00:00	29958	5	39373.781	3787.4632	1183.5823	44344.8265
SO43696	43696	279	31/05/2011 00:00:00	29849	5	419.4589	40.2681	12.5838	'08
SO43845	43845	279	01/07/2011 00:00:00	29888	5	8580.0739	823.6669	257.3959	i7
SO43861	43861	279	01/07/2011 00:00:00	29749	5	23401.1062	2244.4088	701.3777	,927
SO43862	43862	279	01/07/2011 00:00:00	29945	5	31000.7804	2987.8703	933.7095	34922.3602

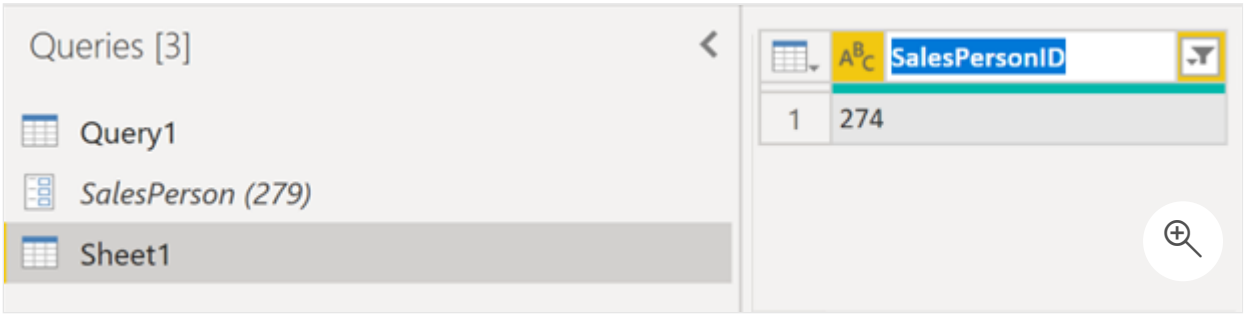
You can now create a report that displays data for one particular value at a time. More steps are needed to display data for multiple values at the same time.

Create dynamic reports for multiple values

To accommodate multiple values at a time, you first need to create a Microsoft Excel worksheet that has a table consisting of one column that contains the list of values.

Next, use the **Get data** feature in Power BI Desktop to connect to the data in that Excel worksheet, and then follow these steps:

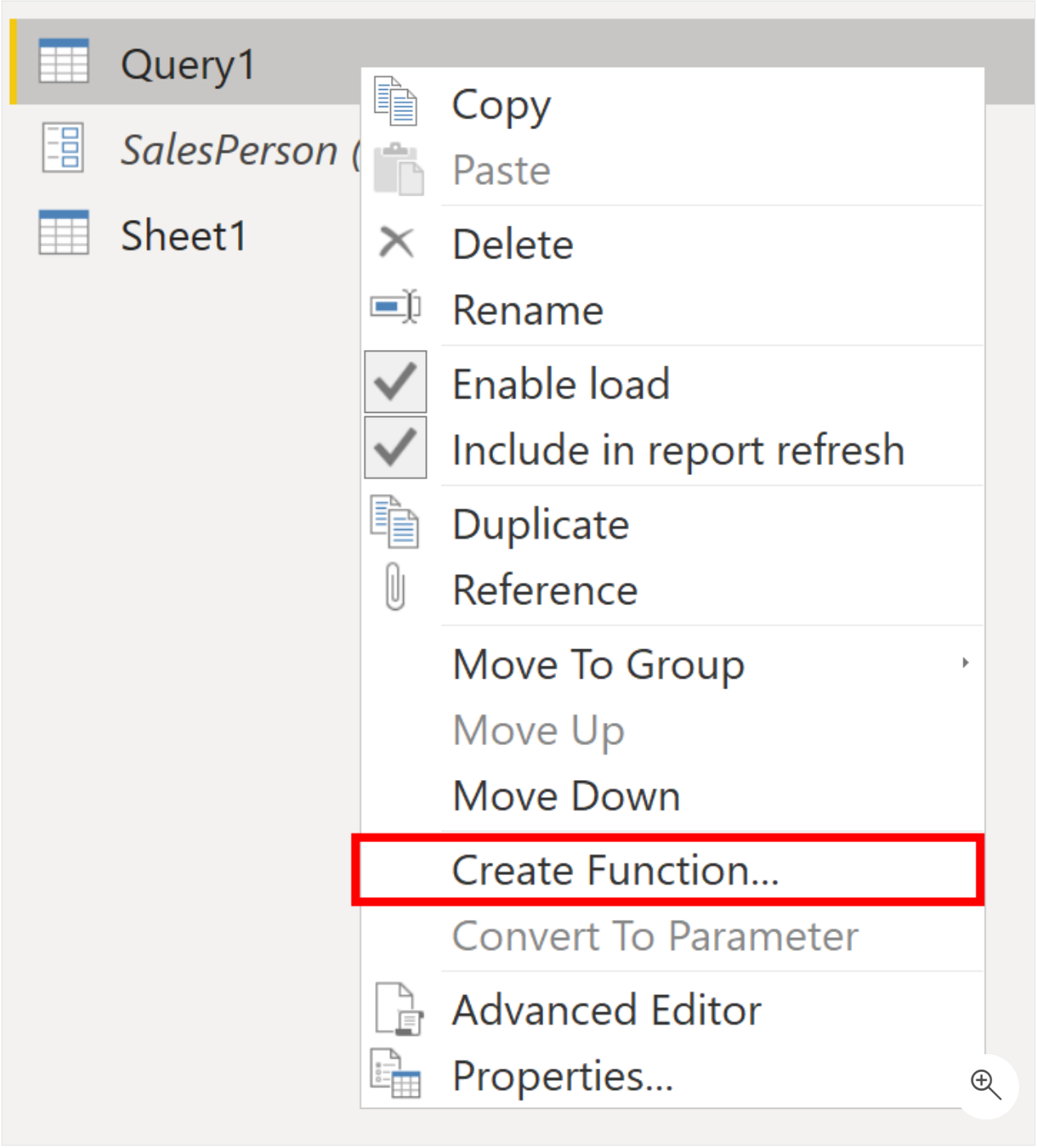
1. On the **Navigator** window, select **Edit** to open the data in Power Query Editor, where you see a new query for the data table.



2. Rename the column in the table to something more descriptive.
3. Change the column data type to **Text** so that it matches the parameter type and you avoid data conversion problems.
4. In the query **Properties** section, change the name of the data source to something more descriptive. For this example, enter **SalesPersonID**.

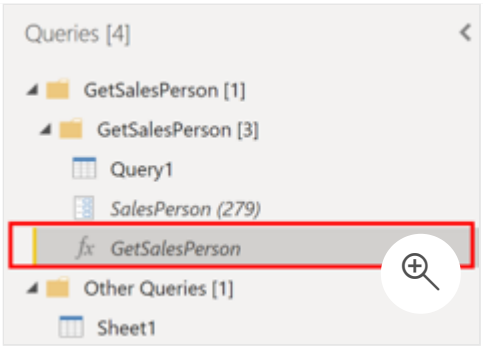
Next, you need to create a function that passes the new **SalesPersonID** query into **Query1**:

1. Right-click **Query1** and then select **Create function**.

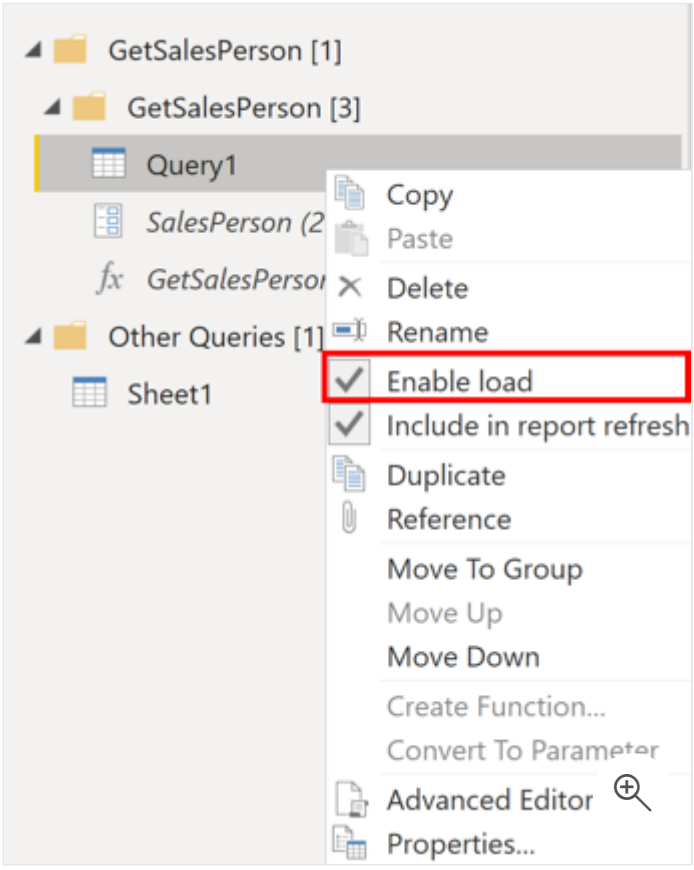


2. Enter a name for the function and then select **OK**.

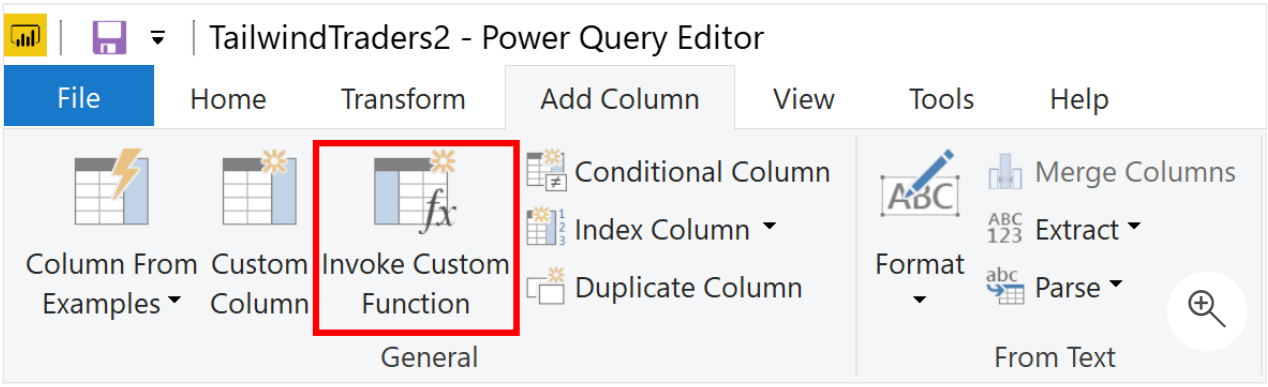
Your new function appears in the **Queries** pane.



3. To ensure that **Query1** doesn't show up in the field list for the report, which could potentially confuse users, you can disable it from loading in the report by right-clicking **Query1** again and then selecting **Enable load** (selected by default) to disable the feature.



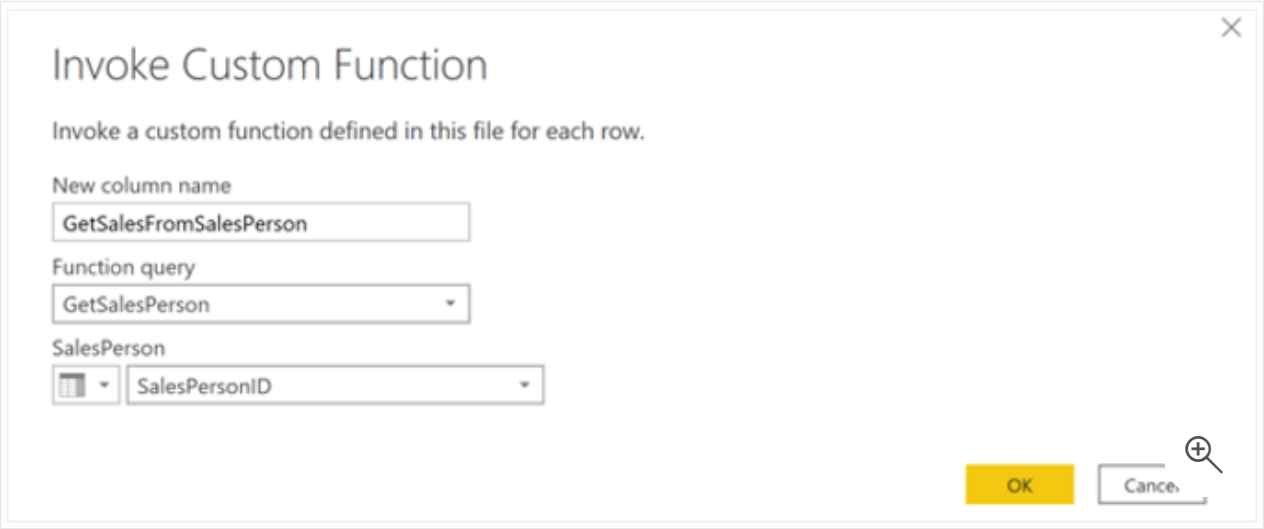
4. Select the **SalesPersonID** query that you loaded from the Excel worksheet and then, on the **Add Column** tab, select **Invoke custom function** to run the custom function that you created.



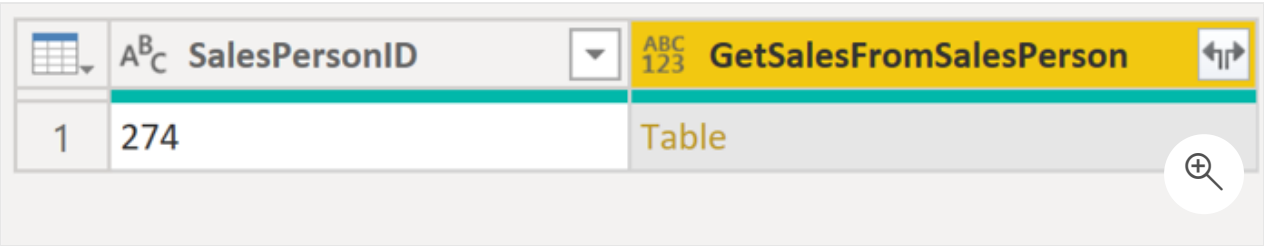
5. On the **Invoke Custom Function** window, select your function from the **Function query** list.

The **New column name** updates automatically and the table that contains the values that you're going to pass through the parameter is selected by default.

6. Select **OK** and, if necessary, run the native query.



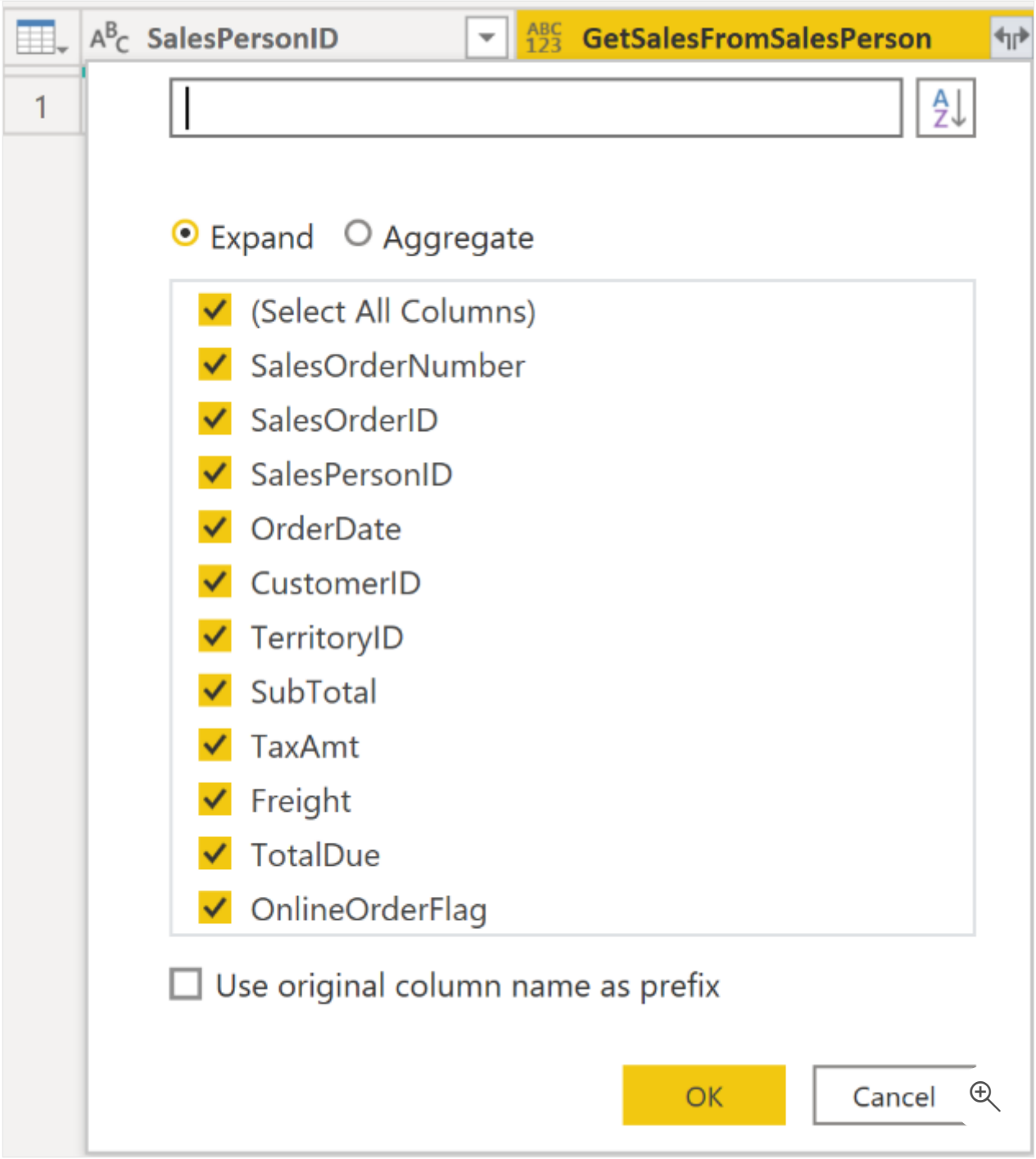
A new column for your **GetSalesFromSalesPerson** function appears next to the **SalesPersonID** column.



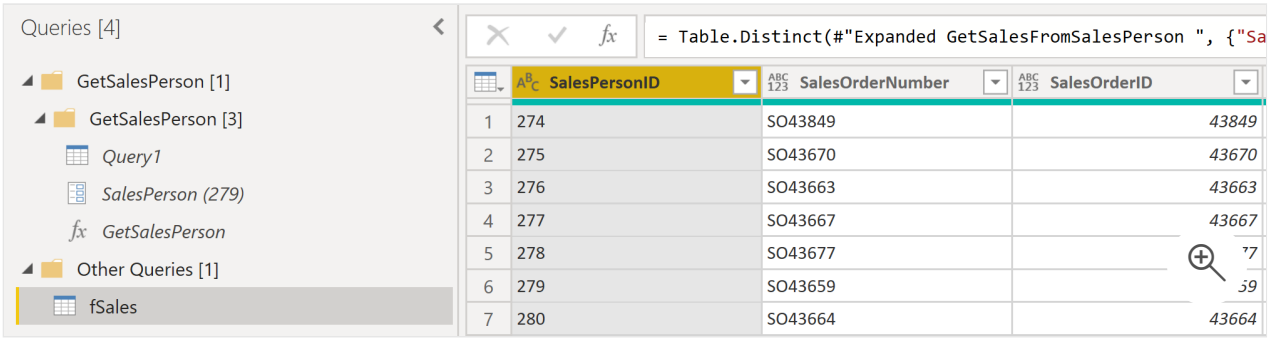
7. Select the two arrows icon in the new column header and then select the check boxes of the columns that you want to load. This section is where you determine the details that are available in the report for each value (sales person ID).

8. Clear the **Use original column name as prefix** check box at the bottom of the screen because you don't need to see a prefix with the column names in the report.

9. Select **OK**.



You should be able to view the data for the columns that you selected, for each value (sales person ID).



If necessary, you can add more values (sales people IDs) to the **SalesPersonID** column in the Excel worksheet, or you can change the existing values.

10. Save your changes and then return to Power Query Editor.
11. On the **Home** tab, select **Refresh Preview**, and then run the native query again (if necessary). You should see the sales from the new sales people IDs that you added into the worksheet.
12. Select **Close and Apply** to return to the report editor, where you see the new column names in the Fields pane.

Now, you can start building your report.

Next unit: Get data from a NoSQL database

Continue >

How are we doing? ☆ ☆ ☆ ☆ ☆

100 XP

Get data from a NoSQL database

5 minutes

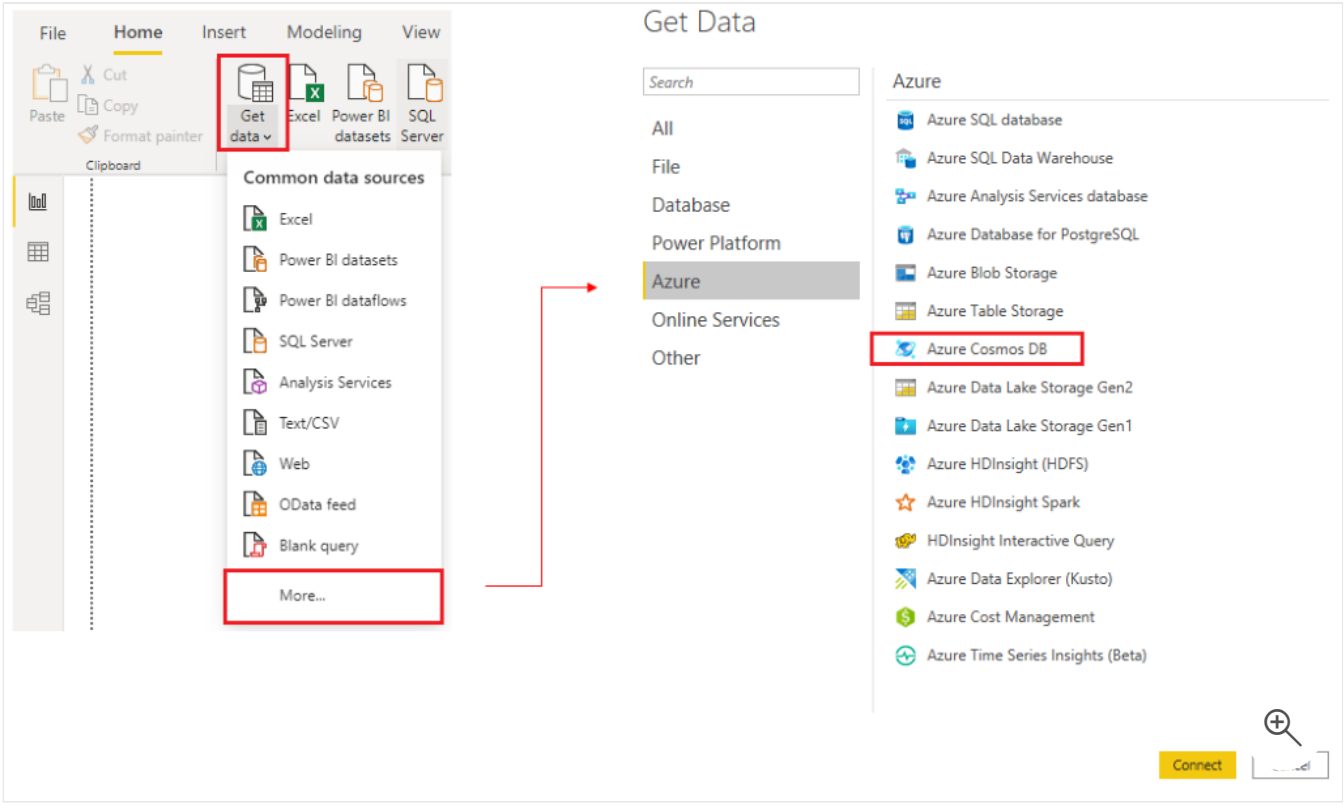
Some organizations don't use a relational database but instead use a *NoSQL* database. A NoSQL database (also referred to as non-SQL, not only SQL or *non-relational*) is a flexible type of database that doesn't use tables to store data.

Scenario

Software developers at Tailwind Traders created an application to manage shipping and tracking products from their warehouses. The application uses Cosmos DB, a NoSQL database, as the data repository. Data is stored as JSON documents, which are open standard file formats that are primarily used to transmit data between a server and web application. You need to import this data into a Power BI data model for reporting.

Connect to a NoSQL database (Azure Cosmos DB)

In this scenario, you'll use the **Get data** feature in Power BI Desktop. However, this time you'll select the **More...** option to locate and connect to the type of database that you use. In this example, you'll select the **Azure** category, select **Azure Cosmos DB,** and then select **Connect**.



On the **Preview Connector** window, select **Continue** and then enter your database credentials. In this example, on the **Azure Cosmos DB** window, you can enter the database details. You can specify the Azure Cosmos DB account endpoint URL that you want to get the data from (you can get the URL from the **Keys** blade of your Azure portal). Alternatively, you can enter the database name, collection name or use the navigator to select the database and collection to identify the data source.

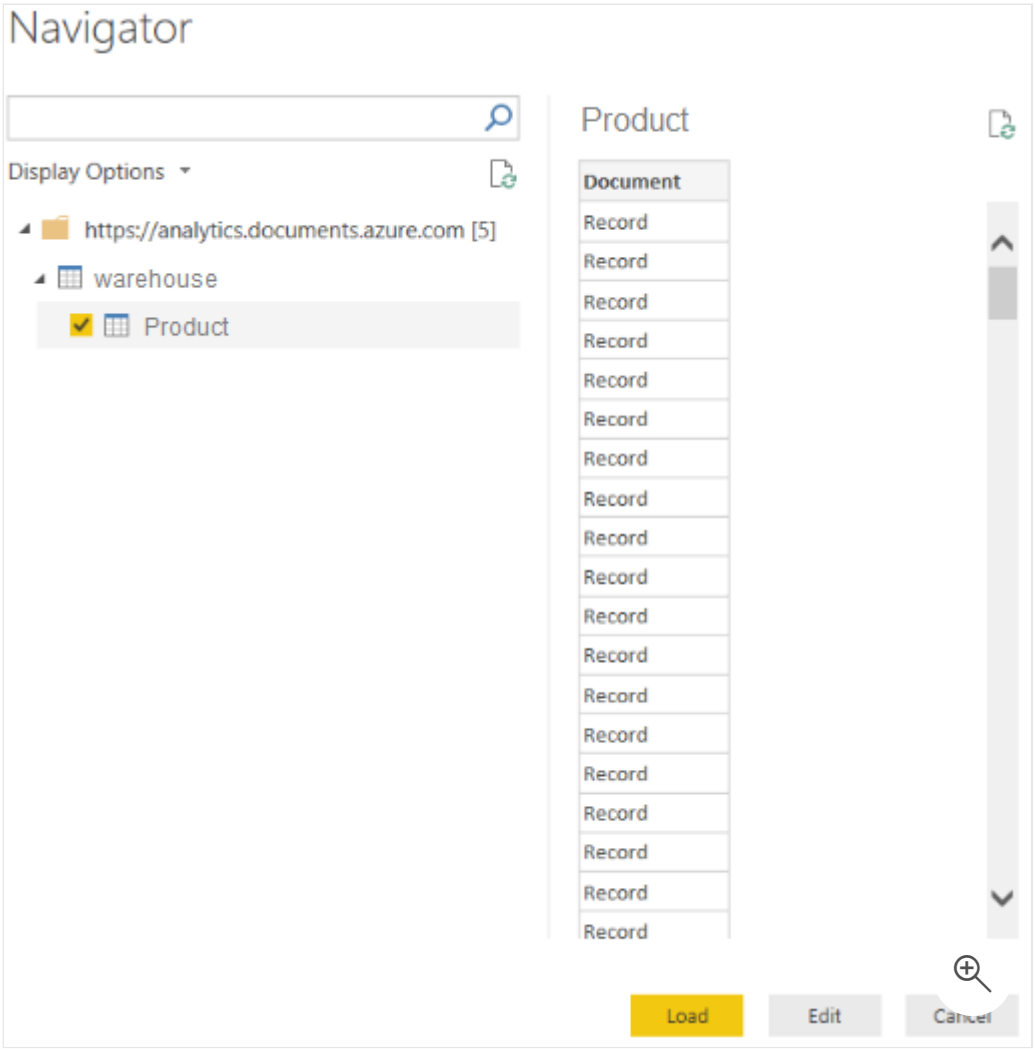
If you're connecting to an endpoint for the first time, as you are in this example, make sure that you enter your account key. You can find this key in the **Primary Key** box in the **Read-only Keys** blade of your Azure portal.

Import a JSON file

If you're working with data stored in JSON format, it's often necessary to extract and normalize the data first. This is because JSON data is often stored in a nested or unstructured format, which makes it difficult to analyze or report on directly.

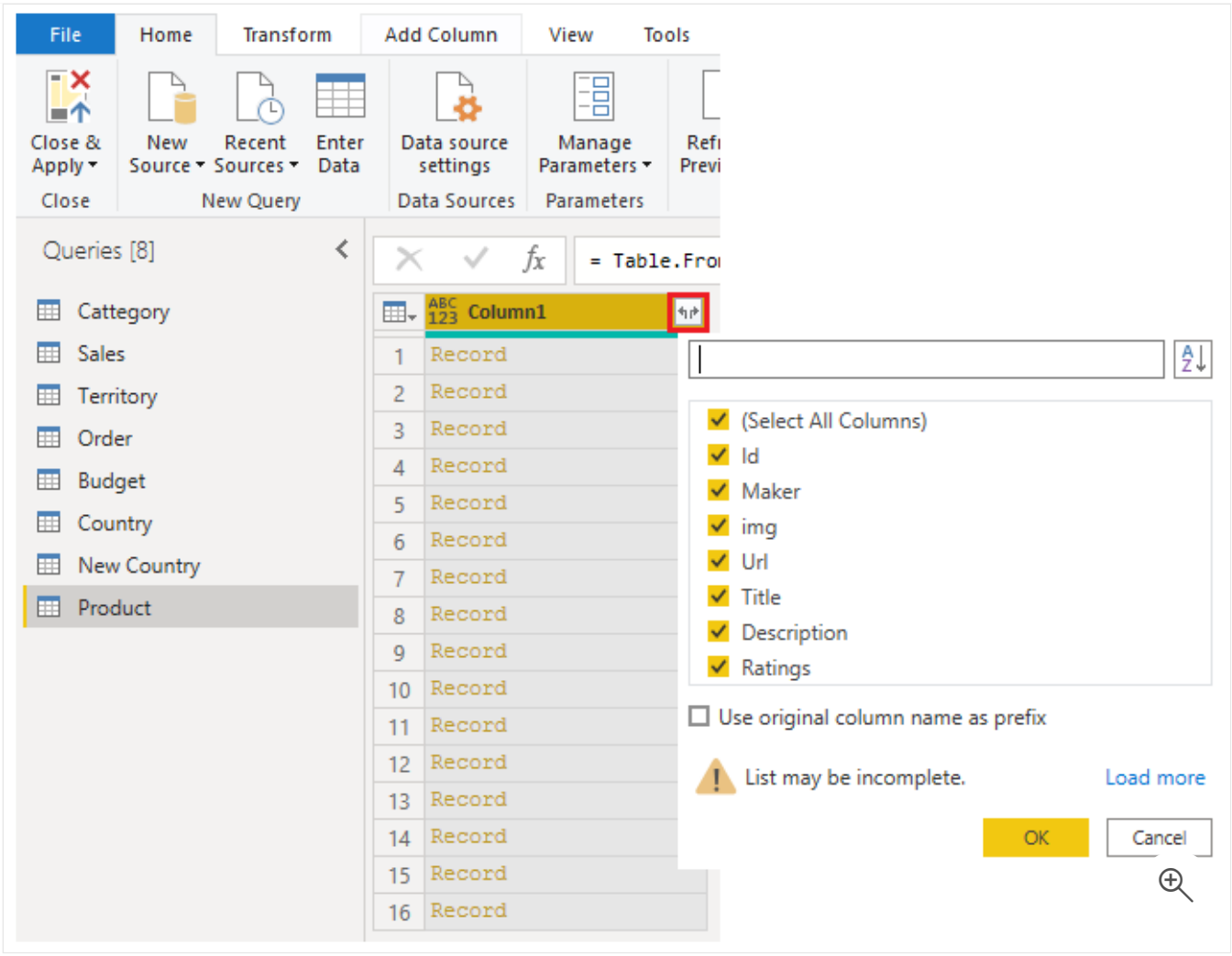
In this example, the data must be extracted and normalized before you can report on them, so you need to transform the data before loading it into Power BI Desktop.

After you've connected to the database account, the **Navigator** window opens, showing a list of databases under that account. Select the table that you want to import. In this example, you'll select the Product table. The preview pane only shows **Record** items because all records in the document are represented as a Record type in Power BI.

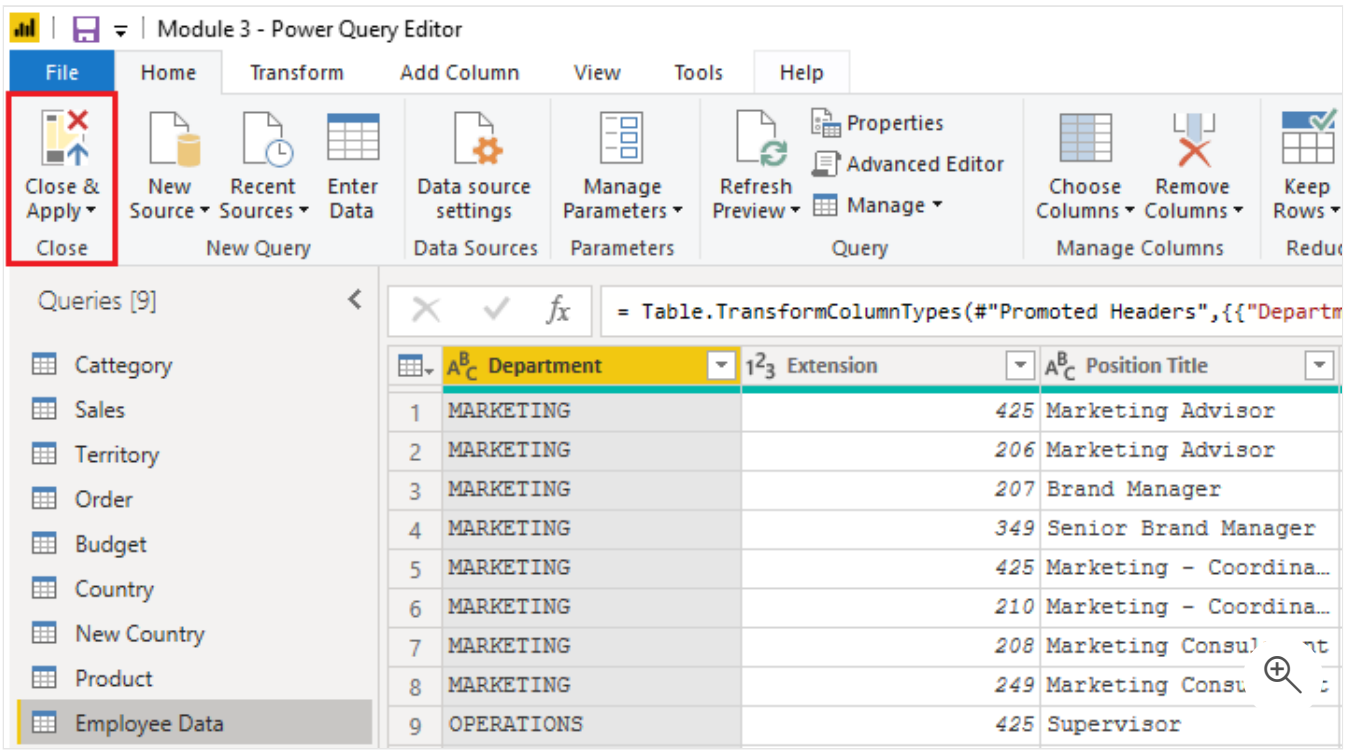


Select the **Edit** button to open the records in Power Query.

In Power Query, select the **Expander** button to the right side of the **Column1** header, which displays the context menu with a list of fields. Select the fields that you want to load into Power BI Desktop, clear the **Use original column name as prefix** checkbox, and then select **OK**.



Review the selected data to ensure that you're satisfied with it, then select **Close & Apply** to load the data into Power BI Desktop.



The data now resembles a table with rows and columns. Data from Cosmos DB can now be related to data from other data sources and can eventually be used in a Power BI report.

Next unit: Get data from online services

Continue >

How are we doing? ☆ ☆ ☆ ☆ ☆

Get data from online services

5 minutes

To support their daily operations, organizations frequently use a range of software applications, such as SharePoint, OneDrive, Dynamics 365, Google Analytics and so on. These applications produce their own data. Power BI can combine the data from multiple applications to produce more meaningful insights and reports.

Scenario

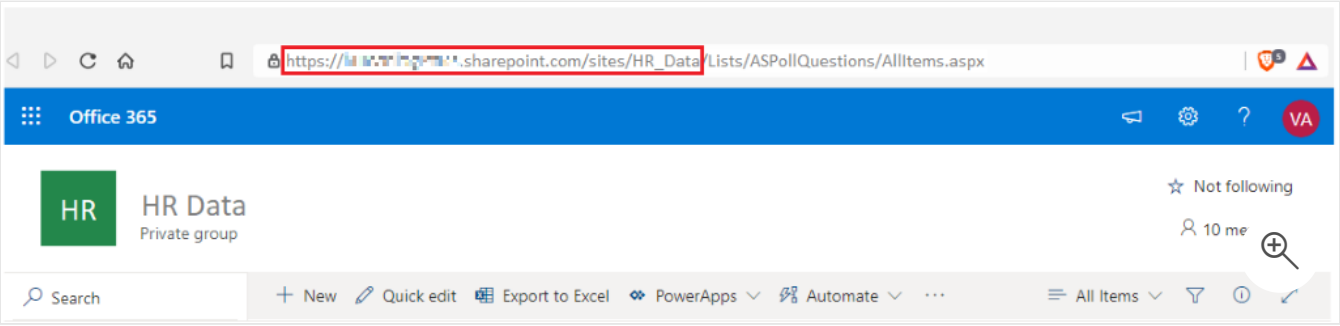
Tailwind Traders uses SharePoint to collaborate and store sales data. It's the start of the new financial year and the sales managers want to enter new goals for the sales team. The form that the leadership uses exists in SharePoint. You're required to establish a connection to this data within Power BI Desktop, so that the sales goals can be used alongside other sales data to determine the health of the sales pipeline.

The following sections examine how to use the Power BI Desktop **Get Data** feature to connect to data sources that are produced by external applications. To illustrate this process, we've provided an example that shows how to connect to a SharePoint site and import data from an online list.

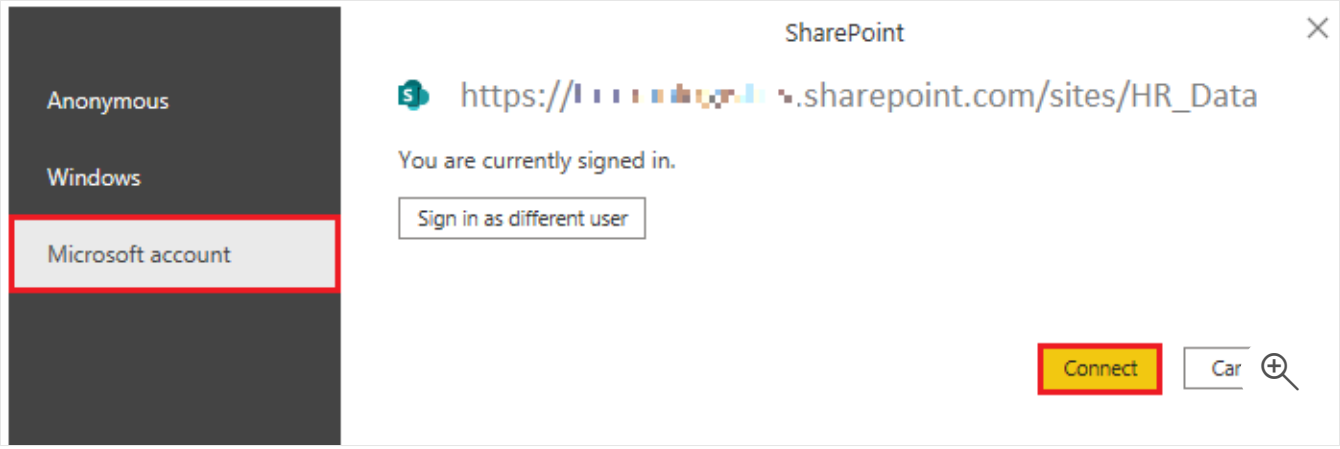
Connect to data in an application

When connecting to data in an application, you would begin in the same way as you would when connecting to the other data sources: by selecting the **Get data** feature in Power BI Desktop. Then, select the option that you need from the **Online Services** category. In this example, you select **SharePoint Online List**.

After you've selected **Connect**, you'll be asked for your SharePoint URL. This URL is the one that you use to sign into your SharePoint site through a web browser. You can copy the URL from your SharePoint site and paste it into the connection window in Power BI. You don't need to enter your full URL file path; you only need to load your site URL because, when you're connected, you can select the specific list that you want to load. Depending on the URL that you copied, you might need to delete the last part of your URL, as illustrated in the following image.



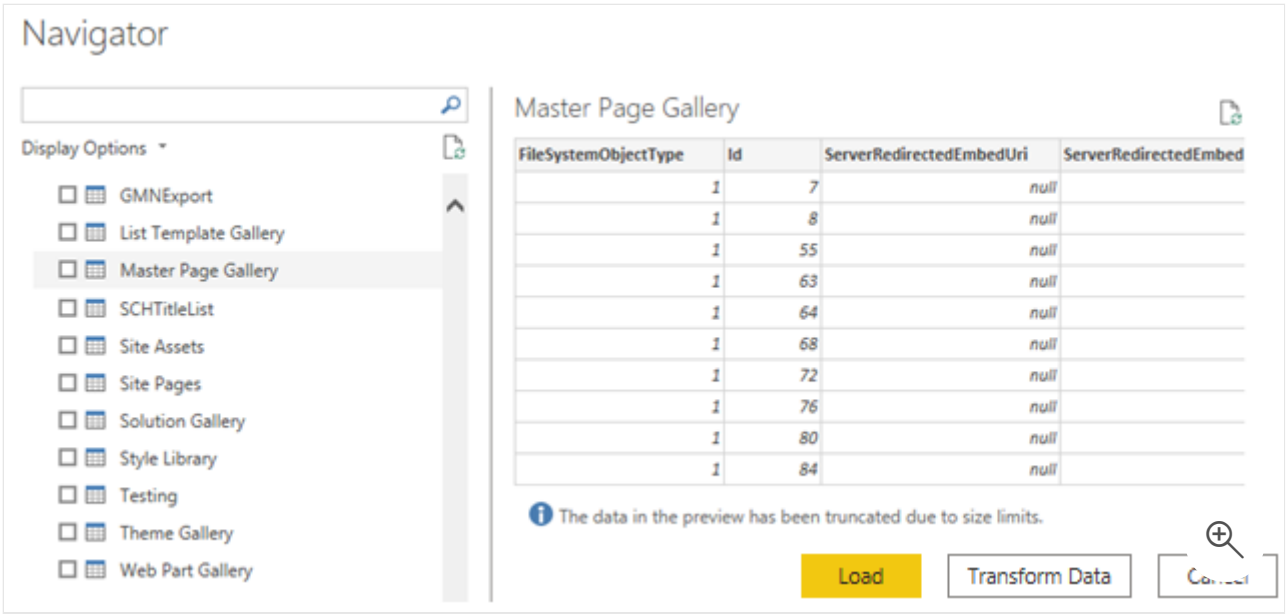
After you've entered your URL, select **OK**. Power BI needs to authorize the connection to SharePoint, so sign in with your Microsoft account and then select **Connect**.



Choose the application data to import

After Power BI has made the connection with SharePoint, the **Navigator** window appears, as it does when you connect to other data sources. The window displays the tables and entities within your SharePoint site. Select the list that you want to load into Power BI Desktop. Similar to when you import from other data sources, you have the option to automatically load your data into a Power BI model or launch the Power Query Editor to transform your data before loading it.

For this example, you select the **Load** option.



Next unit: Select a storage mode

Continue >

How are we doing? ☆ ☆ ☆ ☆ ☆

Select a storage mode

6 minutes

The most popular way to use data in Power BI is to import it into a Power BI dataset. Importing the data means that the data is stored in the Power BI file and gets published along with the Power BI reports. This process helps make it easier for you to interact directly with your data. However, this approach might not work for all organizations.

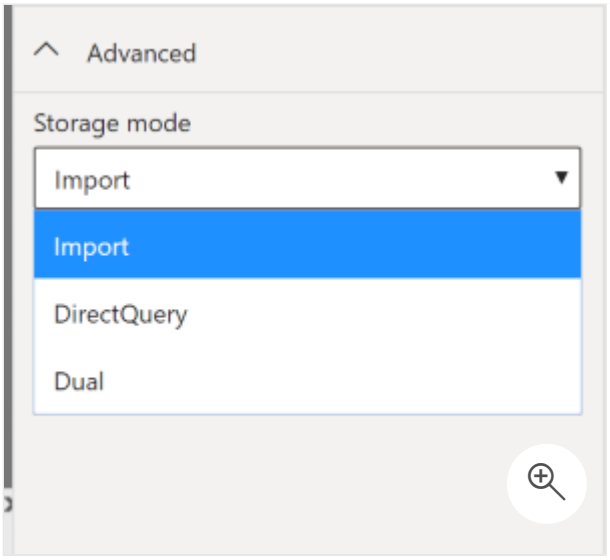
To continue with the scenario, you're building Power BI reports for the Sales department at Tailwind Traders, where importing the data isn't an ideal method. The first task you need to accomplish is to create your datasets in Power BI so you can build visuals and other report elements. The Sales department has many different datasets of varying sizes. For security reasons, you aren't allowed to import local copies of the data into your reports, so directly importing data is no longer an option. Therefore, you need to create a direct connection to the Sales department's data source. The following section describes how you can ensure that these business requirements are satisfied when you're importing data into Power BI.

However, sometimes there may be security requirements around your data that make it impossible to directly import a copy. Or your datasets may simply be too large and would take too long to load into Power BI, and you want to avoid creating a performance bottleneck. Power BI solves these problems by using the DirectQuery storage mode, which allows you to query the data in the data source directly and not import a copy into Power BI. DirectQuery is useful because it ensures you're always viewing the most recent version of the data.

The three different types of storage modes you can choose from:

- Import
- DirectQuery
- Dual (Composite)

You can access storage modes by switching to the **Model** view, selecting a data table, and in the resulting Properties pane, selecting which mode that you want to use from the **Storage mode** drop-down list, as shown in the following visual.



Let’s take a closer look at the different types of Storage Modes.

Import mode

The Import mode allows you to create a local Power BI copy of your datasets from your data source. You can use all Power BI service features with this storage mode, including Q&A and Quick Insights. Data refreshes can be scheduled or on-demand. Import mode is the default for creating new Power BI reports.

DirectQuery mode

The DirectQuery option is useful when you don't want to save local copies of your data because your data won't be cached. Instead, you can query the specific tables that you'll need by using native Power BI queries, and the required data will be retrieved from the underlying data source. Essentially, you're creating a direct connection to the data source. Using this model ensures that you're always viewing the most up-to-date data, and that all security requirements are satisfied. Additionally, this mode is suited for when you have large datasets to pull data from. Instead of slowing down performance by having to load large amounts of data into Power BI, you can use DirectQuery to create a connection to the source, solving data latency issues as well.

Dual (Composite mode)

In Dual mode, you can identify some data to be directly imported and other data that must be queried. Any table that is brought in to your report is a product of both Import and DirectQuery modes. Using the Dual mode allows Power BI to choose the most efficient form of data retrieval.

For more information regarding Storage Modes, refer to Storage Modes.

100 XP

Get data from Azure Analysis Services

5 minutes

Azure Analysis Services is a fully managed platform as a service (PaaS) that provides enterprise-grade data models in the cloud. You can use advanced mashup and modeling features to combine data from multiple data sources, define metrics, and secure your data in a single, trusted tabular semantic data model. The data model provides an easier and faster way for users to perform ad hoc data analysis using tools like Power BI.

To resume the scenario, Tailwind Traders uses Azure Analysis Services to store financial projection data. You've been asked to compare this data with actual sales data in a different database. Getting data from Azure Analysis Services server is similar to getting data from SQL Server, in that you can:

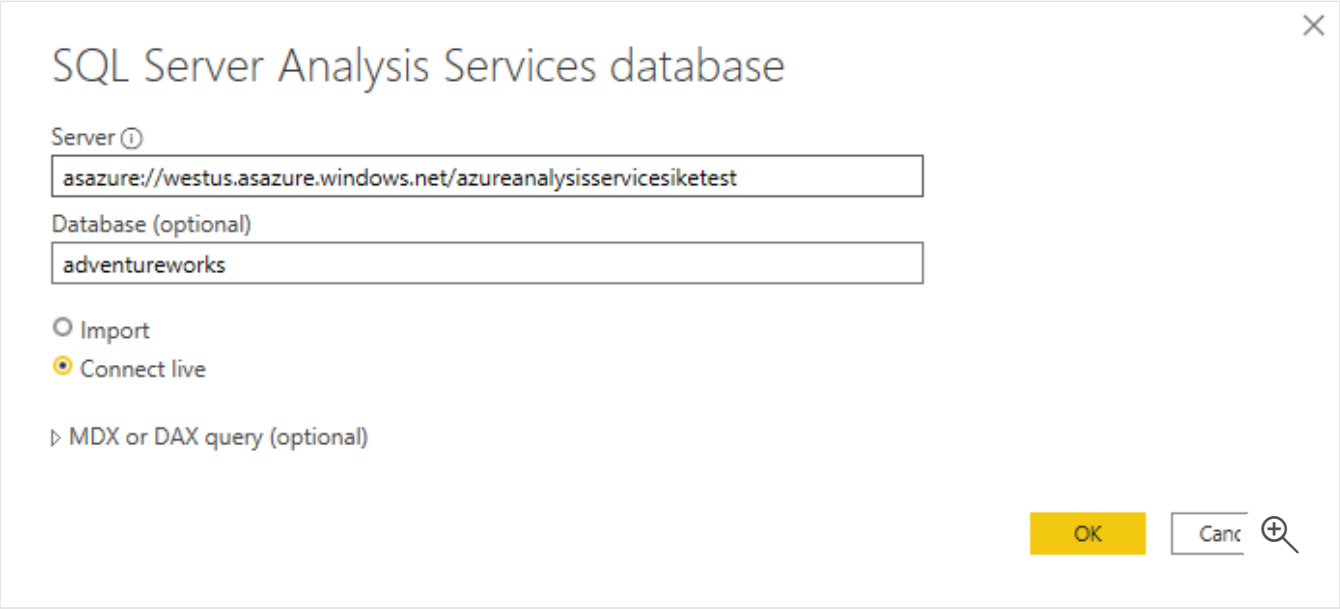
- Authenticate to the server.
- Pick the model you want to use.
- Select which tables you need.

Notable differences between Azure Analysis Services and SQL Server are:

- Analysis Services models have calculations already created.
- If you don't need an entire table, you can query the data directly. Instead of using Transact-SQL (T-SQL) to query the data, like you would in SQL Server, you can use multi-dimensional expressions (MDX) or data analysis expressions (DAX).

Connect to data in Azure Analysis Services

As previously mentioned, you use the **Get data** feature in Power BI Desktop. When you select **Analysis Services**, you're prompted for the server address and the database name with two options: **Import** and **Connect live**.



Connect live is an option for Azure Analysis Services. Azure Analysis Services uses the tabular model and DAX to build calculations, similar to Power BI. These models are compatible with one another. Using the Connect live option helps you keep the data and DAX calculations in their original location, without having to import them all into Power BI. Azure Analysis Services can have a fast refresh schedule, which means that when data is refreshed in the service, Power BI reports will immediately be updated, without the need to initiate a Power BI refresh schedule. This process can improve the timeliness of the data in your report.

Similar to a relational database, you can choose the tables that you want to use. If you want to directly query the Azure Analysis Services model, you can use DAX or MDX.

You'll likely import the data directly into Power BI. An acceptable alternative is to import all other data that you want (from Excel, SQL Server, and so on) into the Azure Analysis Services model and then use a live connection. This approach simplifies your solution by keeping the data modeling and DAX measures in one place.

For more information on connecting Power BI to Azure Analysis Services, see Connect with Power BI documentation.

Next unit: Fix performance issues

Continue >

How are we doing? ☆ ☆ ☆ ☆ ☆

Fix performance issues

10 minutes

Occasionally, organizations will need to address performance issues when running reports. Power BI provides the Performance Analyzer tool to help fix problems and streamline the process.

Consider the scenario where you're building reports for the Sales team in your organization. You've imported your data, which is in several tables within the Sales team's SQL database, by creating a data connection to the database through DirectQuery. When you create preliminary visuals and filters, you notice that some tables are queried faster than others, and some filters are taking longer to process compared to others.

Optimize performance in Power Query

The performance in Power Query depends on the performance at the data source level. The variety of data sources that Power Query offers is wide, and the performance tuning techniques for each source are equally wide. For instance, if you extract data from a Microsoft SQL Server, you should follow the performance tuning guidelines for the product. Good SQL Server performance tuning techniques include index creation, hardware upgrades, execution plan tuning, and data compression. These topics are beyond the scope here, and are covered only as an example to build familiarity with your data source and reap the benefits when using Power BI and Power Query.

Power Query takes advantage of good performance at the data source through a technique called Query Folding.

Query folding

The query folding within Power Query Editor helps you increase the performance of your Power BI reports. *Query folding* is the process by which the transformations and edits that you make in Power Query Editor are simultaneously tracked as native queries, or simple **Select** SQL statements, while you're actively making transformations. The reason for implementing this process is to ensure that these transformations can take place in the original data source server and don't overwhelm Power BI computing resources.

You can use Power Query to load data into Power BI. Then use Power Query Editor to transform your data, such as renaming or deleting columns, appending, parsing, filtering, or

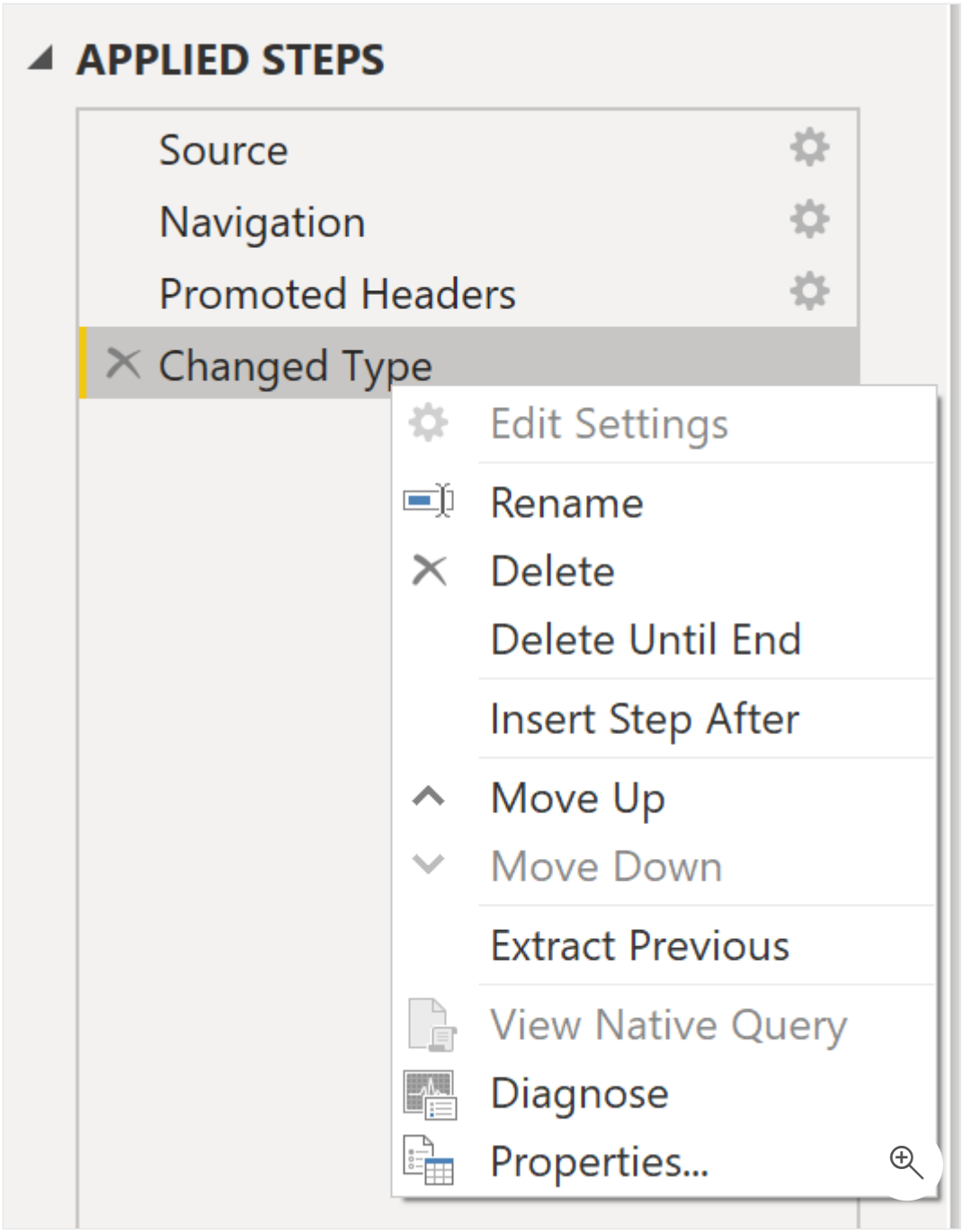
grouping your data.

Consider a scenario where you've renamed a few columns in the Sales data and merged a city and state column together in the "city state" format. Meanwhile, the query folding feature tracks those changes in native queries. Then, when you load your data, the transformations take place independently in the original source, this ensures that performance is optimized in Power BI.

The benefits to query folding include:

- **More efficiency in data refreshes and incremental refreshes.** When you import data tables by using query folding, Power BI is better able to allocate resources and refresh the data faster because Power BI doesn't have to run through each transformation locally.
- **Automatic compatibility with DirectQuery and Dual storage modes.** All DirectQuery and Dual storage mode data sources must have the back-end server processing abilities to create a direct connection, which means that query folding is an automatic capability that you can use. If all transformations can be reduced to a single **Select** statement, then query folding can occur.

The following scenario shows query folding in action. In this scenario, you apply a set of queries to multiple tables. After you add a new data source by using Power Query, and you're directed to the Power Query Editor, you go to the **Query Settings** pane and right-click the last applied step, as shown in the following figure.



If the **View Native Query** option isn't available (not displayed in bold type), then query folding isn't possible for this step, and you'll have to work backward in the **Applied Steps** area until you reach the step in which **View Native Query** is available (displays in bold type). This process will reveal the native query that is used to transform the dataset.

Native queries aren't possible for the following transformations:

- Adding an index column
- Merging and appending columns of different tables with two different sources
- Changing the data type of a column

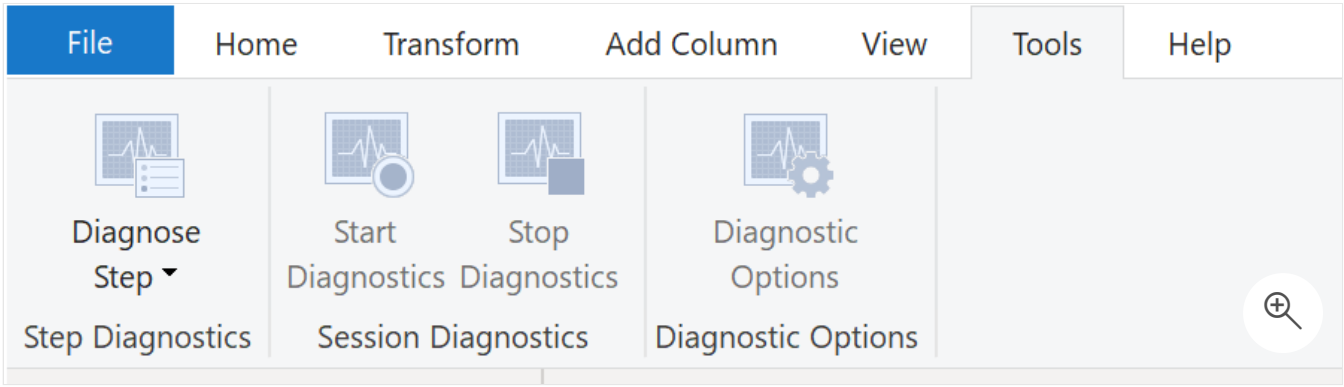
A good guideline to remember is that if you can translate a transformation into a **Select** SQL statement, which includes operators and clauses such as GROUP BY, SORT BY, WHERE, UNION ALL, and JOIN, you can use query folding.

While query folding is one option to optimize performance when retrieving, importing, and preparing data, another option is query diagnostics.

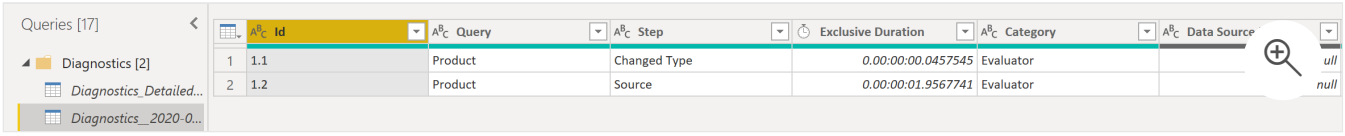
Query diagnostics

Another tool that you can use to study query performance is *query diagnostics*. You can determine what bottlenecks may exist while loading and transforming your data, refreshing your data in Power Query, running SQL statements in Query Editor, and so on.

To access query diagnostics in Power Query Editor, go to **Tools** in the Home ribbon. When you're ready to begin transforming your data or making other edits in Power Query Editor, select **Start Diagnostics** in the **Session Diagnostics** section. When you're finished, make sure that you select **Stop Diagnostics**.



Selecting **Diagnose Step** shows you the length of time that it takes to run that step, as shown in the following image. This selection can tell you if a step takes longer to complete than others, which then serves as a starting point for further investigation.



This tool is useful when you want to analyze performance on the Power Query side for tasks such as loading datasets, running data refreshes, or running other transformative tasks.

Other techniques to optimize performance

Other ways to optimize query performance in Power BI include:

- **Process as much data as possible in the original data source.** Power Query and Power Query Editor allow you to process the data; however, the processing power that is required to complete this task might lower performance in other areas of your reports. Generally, a good practice is to process, as much as possible, in the native data source.

- **Use native SQL queries.** When using DirectQuery for SQL databases, such as the case for our scenario, make sure that you aren't pulling data from stored procedures or common table expressions (CTEs).
- **Separate date and time, if bound together.** If any of your tables have columns that combine date and time, make sure that you separate them into distinct columns before importing them into Power BI. This approach will increase compression abilities.

For more information, refer to Query Folding Guidance and Query Folding.

Next unit: Resolve data import errors

Continue >

100 XP

Resolve data import errors

7 minutes

While importing data into Power BI, you may encounter errors resulting from factors such as:

- Power BI imports from numerous data sources.
- Each data source might have dozens (and sometimes hundreds) of different error messages.
- Other components can cause errors, such as hard drives, networks, software services, and operating systems.
- Data often can't comply with any specific schema.

The following sections cover some of the more common error messages that you might encounter in Power BI.

Query timeout expired

Relational source systems often have many people who are concurrently using the same data in the same database. Some relational systems and their administrators seek to limit a user from monopolizing all hardware resources by setting a query timeout. These timeouts can be configured for any timespan, from as little as five seconds to as much as 30 minutes or more.

For instance, if you're pulling data from your organization's SQL Server, you might see the error shown in the following figure.

Power BI Query Error: Timeout expired

This error indicates that you've pulled too much data according to your organization's policies. Administrators incorporate this policy to avoid slowing down a different application or suite of applications that might also be using that database.

You can resolve this error by pulling fewer columns or rows from a single table. While you're writing SQL statements, it might be a common practice to include groupings and aggregations. You can also join multiple tables in a single SQL statement. Additionally, you can perform complicated subqueries and nested queries in a single statement. These complexities add to the query processing requirements of the relational system and can greatly elongate the time of implementation.

If you need the rows, columns, and complexity, consider taking small chunks of data and then bringing them back together by using Power Query. For instance, you can combine half the columns in one query and the other half in a different query. Power Query can merge those two queries back together after you're finished.

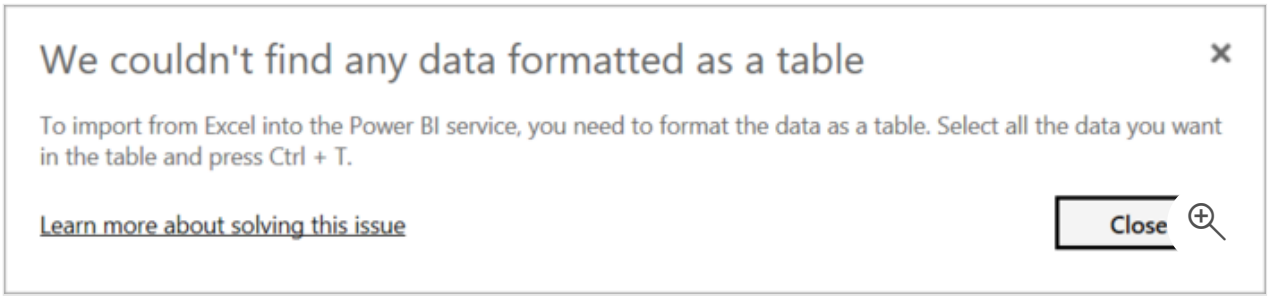
We couldn't find any data formatted as a table

Occasionally, you may encounter the "We couldn't find any data formatted as a table" error while importing data from Microsoft Excel. Fortunately, this error is self-explanatory. Power BI expects to find data formatted as a table from Excel. The error even tells you the resolution. Perform the following steps to resolve the issue:

1. Open your Excel workbook, and highlight the data that you want to import.

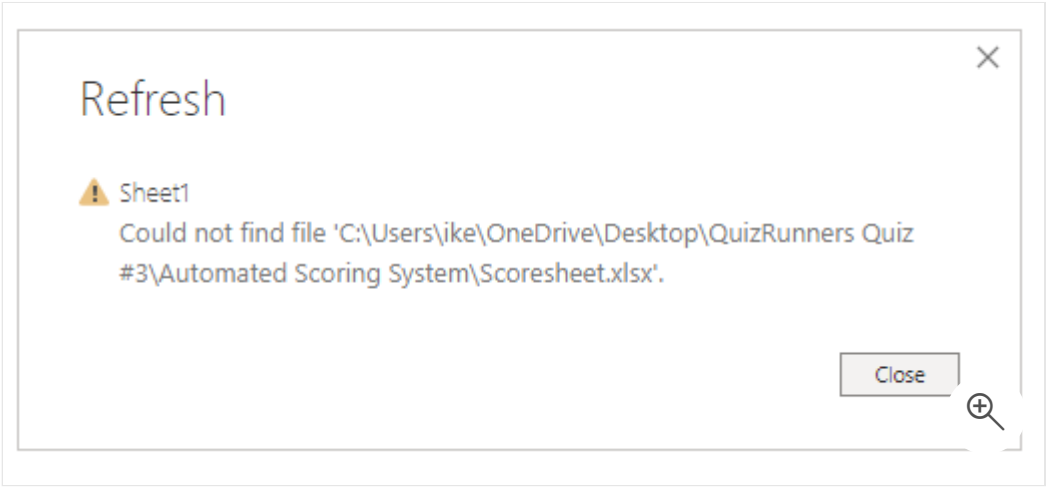
2. Press the **Ctrl-T** keyboard shortcut. The first row will likely be your column headers.

3. Verify that the column headers reflect how you want to name your columns. Then, try to import data from Excel again. This time, it should work.



Couldn't find file

While importing data from a file, you may get the "Couldn't find file" error.

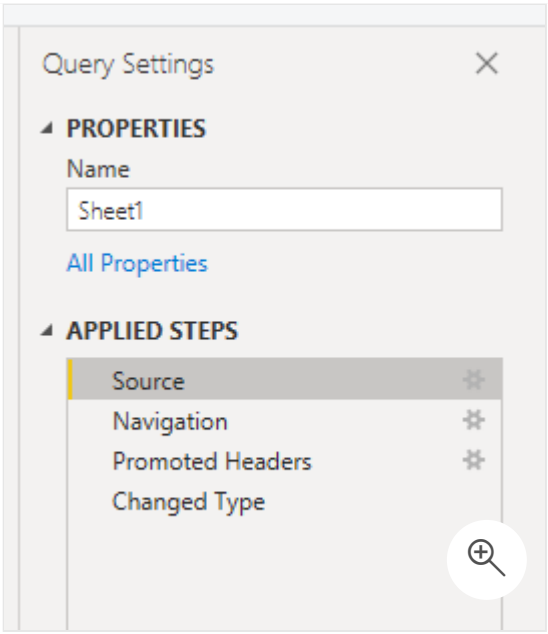


Usually, this error is caused by the file moving locations or the permissions to the file changing. If the cause is the former, you need to find the file and change the source settings.

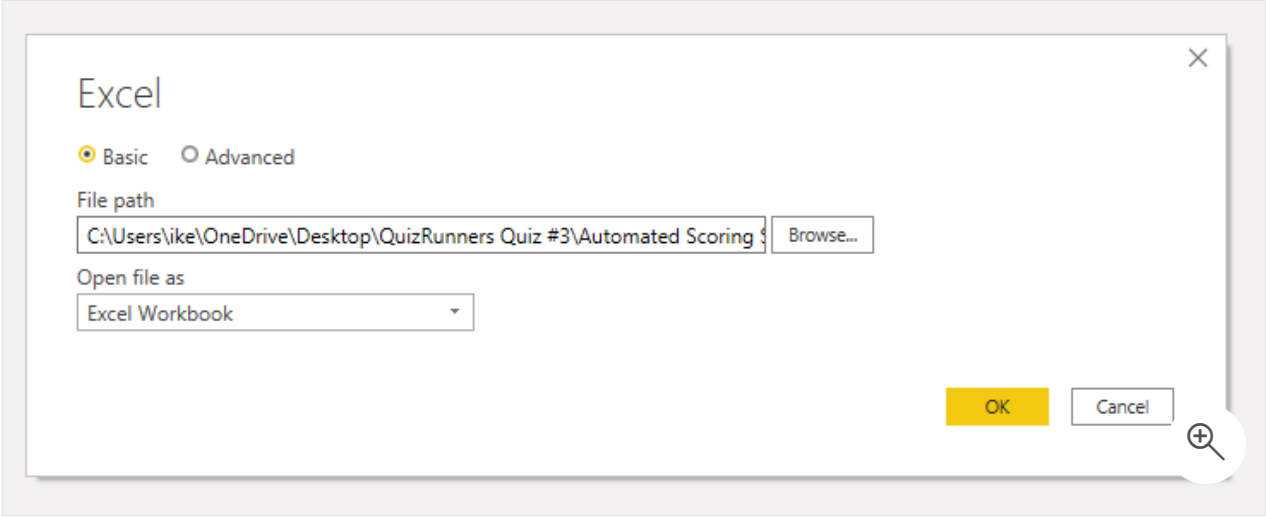
1. Open Power Query by selecting the **Transform Data** button in Power BI.

2. Highlight the query that is creating the error.

3. On the left, under **Query Settings**, select the gear icon next to **Source**.



4. Change the file location to the new location.



Data type errors

Sometimes, when you import data into Power BI, the columns appear blank. This situation happens because of an error in interpreting the data type in Power BI. The resolution to this error is unique to the data source. For instance, if you're importing data from SQL Server and see blank columns, you could try to convert to the correct data type in the query.

Instead of using this query:

```
SELECT CustomerPostalCode FROM Sales.Customers
```

Use this query:

```
SELECT CAST(CustomerPostalCode as varchar(10)) FROM Sales.Customers
```

By specifying the correct type at the data source, you eliminate many of these common data source errors.

You may encounter different types of errors in Power BI that are caused by the diverse data source systems where your data resides.

If you experience an error not covered, you can search Microsoft documentation for the error message, and the resolution you need.

Next unit: Exercise - Prepare data in Power BI Desktop

Continue >

How are we doing? ☆ ☆ ☆ ☆ ☆

5 minutes

Knowledge Check

1. When connecting to a SQL Server database to get data, what language should you use to extract data? *

- ○ DAX

  ✗ Incorrect. You would use DAX language with Power BI and Azure Analysis Services.

- ○ T-SQL

  ✓ Correct. T-SQL is the query language that you would use for SQL Server.

- ○ MDX

2. You're creating a Power BI report with data from an Azure Analysis Services MDX Cube. When the data refreshes in the cube, you would like to see it immediately in the Power BI report. How should you connect? *

- ○ Import
- ○ T-SQL
- ○ Live connection

  ✓ Correct. This will reflect cube changes immediately.

3. What can you do to improve performance when you're getting data in Power BI? *

- ○ Remove unnecessary columns and rows

  ✓ Correct. Always use the least amount of data needed for your project.

- ○ Export database files to CSV to load

  ✗ Incorrect. Database connections allow query folding, which is more efficient than flat files.

- ○ Combine date and time columns into a single column

Next unit: Summary

Practice Assessment for Exam PL-300: Microsoft Power BI Data Analyst

Question 15 of 50

You plan to get data for a Power BI dataset from flat files.

You need to select a location for the files. The location must provide the ability to configure scheduled refresh for the dataset by using Microsoft 365 credentials.

Which two location types should you recommend? Each correct answer presents a complete solution.

- [ ] local file
- [x] OneDrive for Business

✓This answer is correct.

- [x] Personal OneDrive account

This answer is incorrect.

- [x] SharePoint – Team Sites

✓This answer is correct.

A personal OneDrive account provides the ability to automatically synchronize flat files residing in a user's OneDrive and Power BI datasets. Since it relies on OneDrive access, it requires the user's credentials of the corresponding Microsoft account. The OneDrive - Business option uses Azure Active Directory credentials. The SharePoint – Team Sites option uses the same Azure Active Directory credentials as the ones used to access SharePoint Online. For the local file option, no additional credentials are required to access them.

Get data from files - Training | Microsoft Learn

Practice Assessment for Exam PL-300: Microsoft Power BI Data Analyst

Question 16 of 50

You need to make changes to your data sources.

Which three changes are supported by the Data Source Settings in the Power Query interface? Each correct answer presents a complete solution.

- [ ] adding a column
- [x] clearing permissions

✓This answer is correct.

- [x] editing permissions

✓This answer is correct.

- [x] modifying the file path

✓This answer is correct.

- [ ] renaming a column

The Data Source Settings in the Power Query interface supports editing permissions, clearing permissions, and modifying the path of the data source file. Any structural changes to a file, such as adding, removing, or renaming columns are not supported by the Data Source Settings in the Power Query interface.
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Next >

Check Your Answer

Practice Assessment for Exam PL-300: Microsoft Power BI Data Analyst

Question 17 of 50

You have a Power BI dataset that gets data from a table in a SQL Server database.

From which view in Power BI Desktop can you modify the storage mode of the table?

- ○ Data view
- ◉ Model view

✓This answer is correct.

- ○ Page view
- ○ Report view

The storage mode of a table in Power BI Desktop is configurable from the Model view, not the Data or Report view. Page view is an option available from within the Report view.

Select a storage mode - Training | Microsoft Learn

Next >

Check Your Answer

Practice Assessment for Exam PL-300: Microsoft Power BI Data Analyst

Question 18 of 50

You plan to add data to Power BI Desktop from a new data source. You are evaluating whether you should use the DirectQuery storage mode or the Import storage mode.

What are two benefits of using Import instead of DirectQuery? Each correct answer presents a complete solution.

- [x] full support for the Q&A Power BI service

✓This answer is correct.

- [x] full support for the Quick Insights Power BI service

✓This answer is correct.

- [ ] minimized local disk space usage
- [ ] minimized need for data refresh
- [ ] support for per table configuration

The Import storage mode is fully supported with the Q&A and Quick Insights Power BI services. The Import storage, unlike DirectQuery, does not minimize local disk space usage and does not eliminate the need for a data refresh. Both the DirectQuery and Import storage modes support per table configuration
Select a storage mode - Training | Microsoft Learn

Next >

Check Your Answer

Question 19 of 50

You plan to publish a dataset from Power BI Desktop.

You need to ensure that a server name can be changed after the dataset has been published to the Power BI Service.

Which two actions should you perform? Each correct answer presents part of the solution.

- [x] Create a parameter.

✓This answer is correct.

- [ ] Create a query for the server name.

This answer is incorrect.

- [ ] From the Data source settings in Power BI Desktop, update the permissions.
- [x] From the Data source settings, update the server source to use a parameter.

✓This answer is correct.

- [ ] Update the Source applied step of all related queries to reference the server name query.

A parameter is the only part of a query that can be updated or changed in the Power BI service, by accessing the dataset settings. Updating the server source to use a parameter will update all existing queries pointing to the current server to instead use a parameter with that server name. This parameter can now be changed once this dataset is published to the Power BI service.
Get data from relational data sources - Training | Microsoft Learn
Using parameters | Microsoft Learn

Next >

Check Your Answer

Practice Assessment for Exam PL-300: Microsoft Power BI Data Analyst

Question 20 of 50

You create a Power BI data source which uses a SQL `SELECT` statement. The SQL statement queries multiple tables in a SQL Server database and includes subqueries.

When importing data from the data source into Power BI, you receive the following error message: "Timeout expired."

You verify that network connection to the SQL Server has sufficient available bandwidth and low latency.

You need to minimize the occurrences of the timeout issues indicated by the message.

What should you do?

- ◯ Divide the SQL statement into separate data sources.

  ✓**This answer is correct.**
- ◯ Implement aggregations in the SQL statement.
- ◯ Implement groupings in the SQL statement.
- ◯ Replace subqueries with nested queries.

  This answer is incorrect.

Dividing the SQL statement into separate data sources would minimize the amount of processing on the SQL Server side. This would minimize or even eliminate the timeout issues. Groupings, aggregations, and using nested queries would either have no impact on timeout issues or further increase the amount of processing on the SQL Server side, resulting in more frequent timeout issues.
Resolve data import errors - Training | Microsoft Learn

Practice Assessment for Exam PL-300: Microsoft Power BI Data Analyst

Question 17 of 50

You plan to add data to Power BI Desktop from a new data source. You are evaluating whether you should use the DirectQuery storage mode or the Import storage mode.

What are two benefits of using DirectQuery instead of Import? Each correct answer presents a complete solution.

- [ ] full support for the Q&A Power BI service

This answer is incorrect.

- [ ] full support for the Quick Insights Power BI service

This answer is incorrect.

- [ ] minimized local disk space usage

✓This answer is correct.

- [ ] minimized need for data refresh

✓This answer is correct.

DirectQuery minimizes local disk space use and eliminates the need for data refresh. DirectQuery is not fully supported with the Q&A and Quick Insights Power BI services. Both the DirectQuery and Import storage modes support per table configuration.

Select a storage mode - Training | Microsoft Learn

Next >

Check Your Answer

Practice Assessment for Exam PL-300: Microsoft Power BI Data Analyst

Question 19 of 50

When importing data from an Excel workbook into Power BI, you receive the error message: "We couldn't find any data formatted as a table."

What should you do to resolve the error?

- ○ In the Excel workbook, select the data you want to import, select the Data Validation button, and save the change.
- ◉ In the Excel workbook, select the data you want to import, create a table, and save the change.

✓This answer is correct.

- ○ In Power BI, add a template app.
- ○ In Power BI, add an organizational app.

The error message indicates that the Excel workbook does not contain a table. To create it, in the Excel workbook, you need to select the data you want to import, press Ctrl+T or choose the Table button, click OK and save the change. Using the Data Validation button in Excel does not create a table. Organizational and template apps provide a way to implement functionality within Power BI, but, in this case, the issue is caused by an absence of a table in the Excel workbook, so installing an app would have no effect on resolving the issue.

Resolve data import errors - Training | Microsoft Learn

Next > Check Your Answer

Practice Assessment for Exam PL-300: Microsoft Power BI Data Analyst

Question 25 of 50

From Power BI Desktop, you create a data source by importing a Cosmos DB for NoSQL item collection.

You connect to the Cosmos DB account, database, and collection, but the preview displays only a list of items named Record.

You need to select individual fields from items in the collection that you want to load into Power BI Desktop.

What should you do first?

- ◯ Open Power Query Editor.

✓This answer is correct.

- ◯ Retrieve the Cosmos DB account key.
- ◯ Retrieve the Cosmos DB connection string.
- ◯ Switch to the model view.

This answer is incorrect.

This behavior is by design. The Preview pane in Power BI shows a list of Record items when connecting to a collection of JSON formatted items. To view individual item fields, open the Power Query window and use the Expander button on the right side of the Column1 header to display the list of fields. Switching to the model view would not benefit us in any way, since the data has not been imported yet. Retrieving Cosmos DB account key or connection string at this point is meaningless, since that was required to connect to Cosmos DB account, which has been already completed.

Get data from a NoSQL database - Training | Microsoft Learn